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Miller

Mental Tests and the Performance of High School Students as Conditioned by Age, Sex and other Factors

MENTAL TESTS AND THE PERFORMANCE OF HIGH SCHOOL STUDENTS AS CONDITIONED BY AGE, SEX AND OTHER FACTORS

BY

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A. B. Indiana University, 1910

A. M. Indiana University, 1911

THESIS

Submitted in Partial Fulfillment of the Requirements for the

Degree of

DOCTOR OF PHILOSOPHY

IN EDUCATION

IN

THE GRADUATE SCHOOL

OF THE

UNIVERSITY OF ILLINOIS

1917

1917
M61

UNIVERSITY OF ILLINOIS

THE GRADUATE SCHOOL

May 18 1917

I HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER MY SUPERVISION BY Wilford Stanton Miller

ENTITLED Mental Tests and the Performance of High-School Students as Conditioned by Age, Sex, and Other Factors

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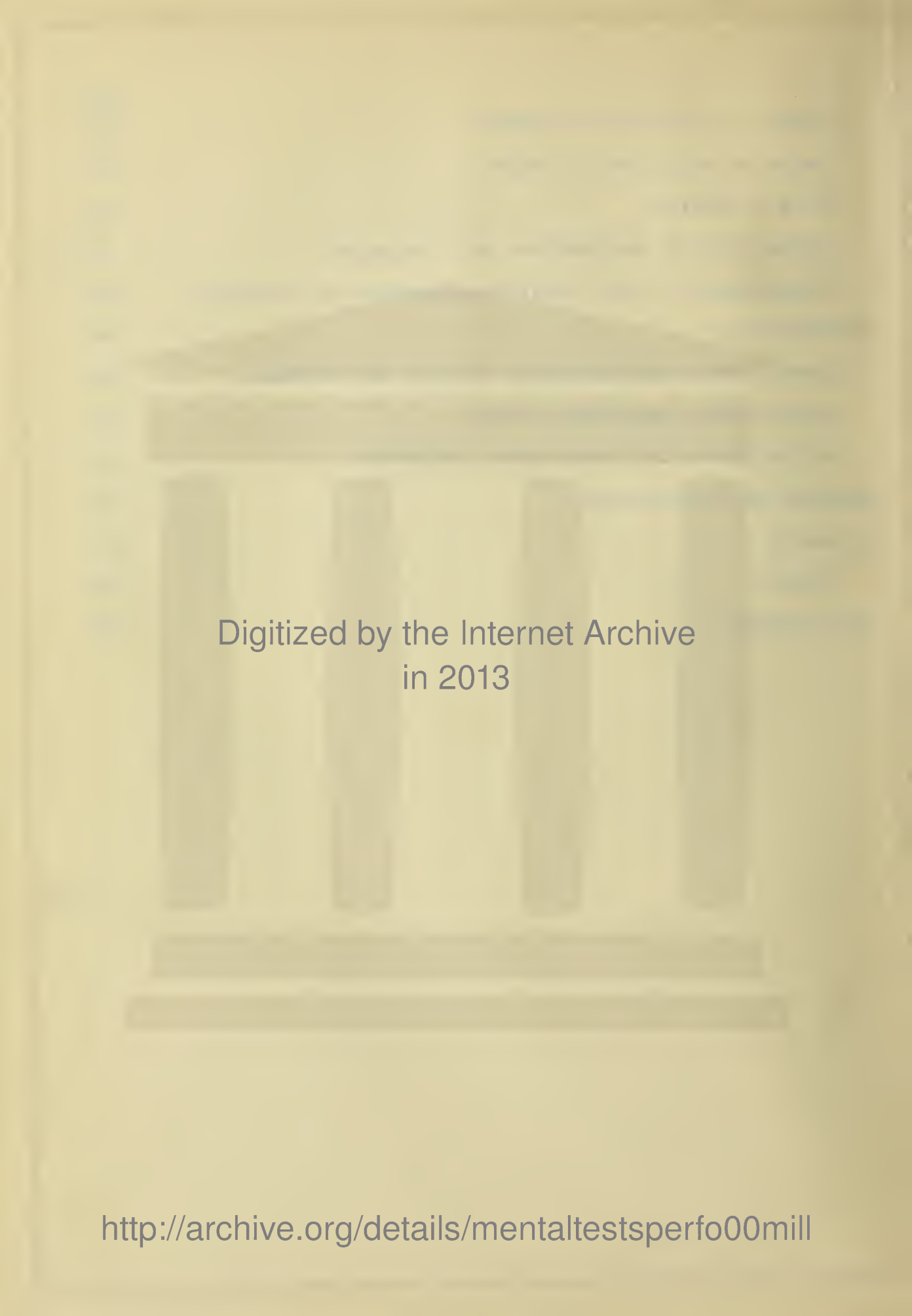
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MENTAL TESTS AND THE PERFORMANCE OF HIGH-SCHOOL STUDENTS AS CONDITIONED BY AGE, SEX, AND OTHER FACTORS

INTRODUCTION

The value of mental tests as a means of determining the mental age of children under twelve years of age is clearly recognized by educators who have made use of the tests that have been standardized in this field. Many tests have been applied to adults, chiefly college students, and as a result some standards have been established. Practically no attempts have been made to establish norms among students of high-school age. The need for standardized tests in this field is quite as great as, if not greater than, the need for such tests among elementary-school children and adults. It is during the high-school period that attention is given to the problem of selecting a vocation. There is probably no single factor more important in the solution of this problem than that of general intelligence.

By general intelligence is meant, to use the characterization of W. Stern, * the capacity of the individual to adapt himself to novel situations, "general mental adaptability to new problems and conditions of life." It should not be confused with memory, which may be present in a marked degree in

*W. Stern, The Psychological Methods of Testing Intelligence, Baltimore, 1914, p. 3.

an individual who possesses a very low degree of general intelligence. Neither should it be confused with talent, which manifests itself in certain restricted directions. Talented individuals may vary greatly in the degree of general intelligence which they possess. In like manner individuals with excellent memories may vary in the degree of general intelligence which they possess.

Although we may expect a high degree of correlation between general intelligence and achievement, the correlation will never be complete because of another very important factor which may be present in only a slight degree in an individual with a high degree of general intelligence. The factor referred to is what we may call industry, or 'persistence of motives.' This factor should not be confused with general intelligence. A group of high-school students with approximately the same persistence of motives may vary considerably in their general intelligence. A student possessed of average general intelligence , may, because of his high persistence of motives, achieve much more than Student B, possessed of the same general intelligence, but of a very low persistence of motives.

No attempt was made in this investigation to determine the persistence of motives by means of mental tests. The purpose of this investigation was (1) to select and to apply certain mental tests to high-school students in such a way as to establish norms for students of different age, grade and sex (2) to determine by the statistical method what tests or groups of tests correlate highest with performance in certain high-school subjects and with general intelligence.

The value of norms for tests designed to call forth

the various mental functions involved in high-school work is obvious. It is necessary to know after a test has been applied where a student ranks with respect to this test among a group of representative high-school students. It is hoped that this investigation will stimulate further research in this field, in order that we may have in the near future norms for many more tests.

With correlations established between the outcome of tests and performance in different high-school subjects, it will be possible for teachers, principals and superintendents to advise a student more intelligently in regard to the curriculum he should pursue. I shall attempt to show, for example, that in the case of certain students it would be practically useless to undertake an engineering course because of inability,as revealed by tests, to master the mathematics required in that course.

Mental tests will aid high-school principals in classifying students on the basis of their ability and thereby will overcome one of the chief difficulties of group instruction. The principal will be able to select, at the very beginning of a semester and with a fair degree of accuracy, the students who under normal classroom conditions will not make normal progress. This will make it possible to provide special assistance before the student is too far behind to profit by such assistance.

By means of mental tests it will be possible to determine whether or not poor work in a subject is due to a low degree of general intelligence. This information will provide a basis for more intelligent educational treatment of the individual student.

Educators have recently been supplied with objective

tests, scales, or measures of achievement which enable them to determine with some accuracy the results of their instruction,- to determine what has happened in the student's mind. The value of such tests cannot be overemphasized. But in mental tests one has a means of predicting what will happen, a means of predicting outcomes under given conditions. One of the advantages of science is the ability which it gives one to measure and to predict outcomes. The use of mental tests is one more step in the direction of making education a science. To be sure, we shall never be able to predict in education with the precision with which we are able to predict in the physical sciences. This fact, however, is no excuse for neglecting to avail ourselves of means to predict more accurately than we are now able to predict.

Sane educators will not consider mental tests as a panacea for all educational ills, but they should welcome them as a means of giving some additional knowledge which should make their relations with their students more intelligent. Mental tests should serve as another instrument for educational diagnosis.

An investigation of this kind is possible only when the experimenter can secure the hearty coöperation of the students, the principal, and the superintendent in the school in which the investigation is carried on. The author is deeply indebted to the students of the Urbana, Illinois, High School for their interest and coöperation. The author further desires to express his thanks to Superintendent A. P. Johnson, to Principal M. L. Flaningam,and to the teachers of the High School, for the generous contribution of time and labor which they gave during the four months the tests were being applied.

THE SELECTION OF THE TESTS

The selection of the tests was based upon two general principles: (1) that no single test would serve as an index of general intelligence; rather, that a group of tests that showed low inter-correlations would be a better index; (2) that, assuming certain school subjects make special demand upon certain mental functions, particular tests might be found that would show high correlations with performance in particular high-school subjects.

Unfortunately, when we began our work very few norms for students of high-school age had been established for the various tests from which the tests in this investigation were selected. Their inter-correlations were not available, and it was necessary to select the tests between which one would expect to find low correlations, largely by *a priori* assumptions.

On the assumption that good performance in certain subjects, like the languages, would require good memories, two tests of logical memory were given, the *Dutch Homestead* and the *Marble Statue*. In the former, the material was presented visually; in the latter, orally.

On the assumption that ability to perceive relations quickly would be at a premium in mathematics and the sciences, the *analogies* test was selected.

The *cancellation* test was included on the assumption that, among other things, it tested speed in performing a rela-

tively simple and mechanical task.

The cause and effect test, a modification of a test described by Reis, was selected because of its high correlation with general intelligence.

The hard-directions test was selected because it promised much as a test of general intelligence.

The word-building test was selected because its correlation with the other tests has been found to be relatively low.

METHOD OF APPLYING THE TESTS

The seven tests were given to the following numbers of students:

1. Cancellation (Group test)- - - - - 372 students
2. Dutch Homestead (Group test) - - - 358 students
3. Marble Statue (Group test) - - - - 358 students
4. Analogies (Individual test) - - - 200 students
5. Cause and Effect (Individual test) 200 students
6. Directions (Group test) - - - - - 331 students
7. Word Building (Group test) - - - - 357 students

By the aid of a seconds-clock devised by Whipple we were able to use the work-limit method successfully in the cancellation test and in the directions test. The work-limit method is better than the time-limit method since it is difficult to arrange the material of a test in such a way as to make the task of equal objective difficulty at every portion of the test, and to avoid the subjective variations due to the fact that different S's accomplish different amounts of work.* Suppose, for example, the time-limit method had been used in the directions test. Then

*G.M. Whipple, Manual of Mental and Physical Tests, Baltimore, 1914, p. 8.

it would have been necessary to stop all students after a given time. Suppose Student A had completed one half of the test and Student B three fourths of it. It would not then follow that B was 1½ times as efficient as A. By means of the seconds-clock we were able to measure efficiency in terms of elapsed time rather than in terms of 'ground covered.'

To insure accuracy in reading the seconds-clock all students were given a drill in reading it before the tests were applied. They were told to look away from the clock and at a signal ready they looked at the clock, locating first the position of the large second-hand which gave them the seconds. The minutes could be read directly from the figure in the small circular opening on the dial. This was repeated until all understood the method.

1. Cancellation Test

In the cancellation test the subjects were required to cancel as rapidly as possible all of the 7's on a sheet containing one thousand digits, (0 - 9) arranged in twenty rows of fifty digits each.*

The following directions were read to the group twice, after which questions as to method were answered:

"When I say ready, turn over this sheet of paper, begin at the first line, and mark a line through every 7 on the page like this [illustrate]. Mark as rapidly as you can, but try not to leave out any 7's. When you have finished the last line, look at the clock immediately and record in the lower right-hand corner of the sheet your time in minutes and seconds. Do not make any changes after you have recorded your time, but write

*G. M. Whipple, Manual of Mental and Physical Tests, Baltimore, 1914. Part II, Test 39.

your name, year in high school, and date of birth at the top of the sheet, then turn it face down. Are there any questions?"

2. The Dutch Homestead*

This test is designed to test the subject's immediate recall of the text, which he is given three minutes to read. The following directions were read to the group twice, after which questions as to method were answered:

"You will have 3 minutes to read the passage of prose on the opposite side of the sheet. Three minutes will be ample time to read it over carefully several times. At the signal, ready, you will turn the sheet over, read the passage straight through twice and then commit it to memory by any method you wish. At the signal, stop, you will place the sheet you have been reading face down on your desk and write at once on the large blank sheet, under the heading which you have already filled out, as much of the passage as you can remember. If you can remember it in just the words of the passage, use those words, but if you can't do that, tell in your own words as well as you can, what it was that you read. Ample time will be given for you to do this. When you have finished, turn this sheet face down. Are there any questions?" After all hadfinished writing, the instructions were given: "Count the total number of words you have written. Record this total on your blank."

3. The Marble Statue**

This test is designed to test the subject's immediate recall of the text, which was read to him once. Care was taken to read the text with uniform emphasis and rate to the different

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*G.M. Whipple, Manual of Mental and Physical Tests, Baltimore, 1914, Part II, Test 39.

**Whipple's Manual, Test 39.

groups. The reading required from 60 to 70 seconds. The following directions were read twice, after which questions as to method were answered:

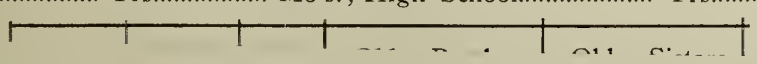
"I am going to read you something to see how well you can remember it afterward. You must pay careful attention, as I shall read it but once. As soon as I have finished, take your pencil and write as much of the story as you can remember. If you can remember it in just the words you have heard, use those words, but if you can't do that, tell in your own words, as well as you can, what it was that I read to you." Ample time will be given for you to do this. When you have finished, turn this sheet face down. Are there any questions?" After all had finished, the instructions were given: "Count the total number of words you have written. Record this total on your blank."

4. Analogies Test*

Just before giving the analogies test, which preceded the cause and effect test, the experimenter secured from the

..... Date of Birth..... Class..... No.....

Age, Elementary School..... Yrs..... Mo's.; High School..... Yrs.....Mo's.



groups. The reading required from 60 to 70 seconds. The following directions were read twice, after which questions as to method were answered:

"I am going to read you something to see how well you can remember it afterward. You must pay careful attention, as I shall read it but once. As soon as I have finished, take your pencil and write as much of the story as you can remember. If you can remember it in just the words you have heard, use those words, but if you can't do that, tell in your own words, as well as you can, what it was that I read to you." Ample time will be given for you to do this. When you have finished, turn this sheet face down. Are there any questions?" After all had finished, the instructions were given: "Count the total number of words you have written. Record this total on your blank."

4. Analogies Test*

Just before giving the analogies test, which preceded the cause and effect test, the experimenter secured from the student the information indicated on the accompanying blank.

*Whipple's Manual, Test 34A

This gave an opportunity for the experimenter to gain an acquaintance with the student and to eliminate the distractions that would be likely to arise if the tests had been given the moment the studentcame into the presence of a stranger. The individual tests were given in a room free from distractions, adjoining the superintendent's office.

The analogies test requires the subject to perceive as quickly as possible the relation between two words arranged as the first and second term of a simple proportion and to speak aloud as soon as possible the missing fourth term which will bear the same relation to the third term as the second term bears to the first. The three terms of each proportion were typewritten on separate cards. The cards were exposed one at a time after a ready signal, and the time of each response was recorded in tenths of a second. If the subject did not give a correct response, he was told to try again. He could make repeated trials, but if he did not succeed in giving a correct response within thirty seconds, he was given no more trials and the time was recorded as 300 tenths of seconds. There are seven cards in the preliminary test and twenty cards in the regular test.

The following directions were given to each subject, with Card No. 1 (Hee-haw : donkey :: Bow-wow : _____) before him: "On each of these cards there are three words, as on this one. As you see, there is a relation between the first and the second word. You are also given a third word, and I want you to find a fourth word which shall have the same relation to the third as the second has to the first. Work as rapidly as you can and say the fourth word aloud as soon as you know what it should be. Thus, in this first card, the fourth word is what? The relation does

not remain the same as this one, but varies from one card to another. If at any time you perceive the relation but are unable to speak the fourth word, please make a remark that will indicate that you perceive the relation but are unable to speak the word, for example [referring to Card No. 1 before him], if you are unable in this case to speak at once the word dog because of a lack of information, you should make a remark that would indicate that you see the relation; thus you might say, 'The animal that goes bow-wow' or 'I can't think of the name of the animal that makes that noise.' Your remark should make clear to me that you perceive the relation. I should not stop the watch if you would merely say, 'I can't think of the word,' since this would not make clear to me that you actually saw the relation."

Care was taken before the test to make certain that the subject understood the meaning of the colon and double colon and that he knew how to read them. It was necessary to guard against guesses in Cards 2, 8, 10, 16, and 20. With these cards the subject was asked to state the relation which was the basis for his answer, for example in No. 3 when the response sun was given, he was asked; "How is the moon to the earth as the earth is to the sun?" If he showed by his answer that he perceived either the relation of relative size or that of revolution, his response was considered satisfactory and the time recorded. If he could not give the basis for his response, he was told to try again and the time for the correct response was recorded.

This test was given individually to 200 students, 50 from each of the four classes in the high school. In order to get a non-selected group, the first 50 in each class were taken from an alphabetical class roll.

To check the dissemination of information each student was requested to say nothing to students who had not taken the test. To test the effectiveness of this precaution the scores of the students were averaged by tens in the order of taking the test. These averages were constant thruout. If information in regard to the test had become general among those who had not taken it, the time would have been shorter for those who came later in the series. This was not the case.

5. Cause and Effect Test

This test was given individually to the same students who took the analogies test and was given directly after it. It resembles that test in being a form of controlled association test, though there is much more latitude in the responses possible in cause and effect combinations.

The following directions were given: "On the cards which I shall show you there will be written one word, a noun. You will think of the noun on the card as a cause and speak aloud just as soon as possible a single word, a noun, which may be an effect of the noun on the card. For example, if the noun rain should appear on a card, you might say bad roads, but this would be incorrect, since the effect must be expressed with a single word. You might say wet; this would be incorrect, since wet is an adjective - the effect must be a noun. You might say water which would be incorrect; rain does not cause water; rain is water in motion. Water is a synonym rather than an effect of rain. You might say destruction; this would be correct, altho rain does not always cause destruction. It is not required that you speak a noun that is always an effect of the one on the card, but one that may be an effect. In this test when you are told to try again, it

does not mean that your answer is incorrect; it means that I am uncertain as to the correctness of your answer. In some cases you may be asked to give as many as three replies. Now we will try this preliminary test to make certain that you understand what is wanted."

During the preliminary test and the test proper which followed immediately, the pupil was informed of his error when he gave an adjective or a synonym. These errors were common among pupils who made a poor record in the test.

The five nouns used in the preliminary test were:

fire, thaw, practice, science, exile

In the test proper the following twenty nouns were used:

1. Nourishment, 2. Fall, 3. Education, 4. Famine, 5. Honesty, 6, Storm, 7. Drouth, 8. Evidence, 9. Fertility, 10. Guilt, 11. Idleness, 12. Proposal, 13. Diligence, 14. Jealousy, 15. Falsehood, 16. Quarrel, 17. Age, 18. Vice, 19. Treason, 20. Tyranny.

This list was selected from a list of fifty nouns which was first tried out on about 300 university juniors and seniors.

6. Directions Test

Woodworth and Wells' hard directions test* was used.

The following directions were read twice: "At the signal ready you will turn over the blank and do just what it tells you to do. Work just as rapidly as you can. When you have finished look at the clock immediately and record in the lower right-hand corner of the sheet your name, year in high school and the date of your birth. Then turn the paper face down. Avoid making

*R. S. Woodworth and F. L. Wells, Psychological Review Monograph, December 1911, p. 72.

any confusion that would disturb others. Some of the directions may amuse you, but please refrain from laughing aloud."

7. Word-Building Test

The pupil was provided with the aeobmt-test* and was given the following directions: "Make as many words as you can from the six letters given on this blank. You may use any number of letters from one to six, but no letter may be used twice in the same word, and no other letters than these six are to be used. You will have five minutes. There are spaces on the blank for 22 words. This does not mean that only 22 words can be formed from these letters. When you have filled the 22 spaces, continue writing in the margin as many words as you can form until time is called. Are there any questions?" The test was concluded by the use of the eairl- test** after giving once more the same instructions.

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*Whipple's Manual, Test 47.

**Whipple's Manual, Test 47.

SCORING OF THE TESTS

1. Cancellation

The score in this test was determined by the formula $E=\frac{A}{T}$ where E is efficiency. A is accuracy (100% less one per cent for each digit (7) omitted), and T is time in seconds. For example, the efficiency of a student who omitted ten 7's and whose time was 150 seconds would be .60. By substituting the values of A and T in the formula, $E = \frac{90}{150}$ or .60.

2. Dutch Homestead
3. Marble Statue

In these tests the score was the number of ideas reproduced. The method of scoring used was the same as that recommended for these tests in Whipple's Manual, Test 39.

4. Analogies

In this test the score was the total time in seconds required for the twenty responses. The following responses were considered correct:

1. Grain, Wheat, Oats, Barley, Rye, Harvest
2. Man, Human, Person, Boy, Girl, Monkey
3. Sun
4. Sand(s), Pebbles, Shells
5. Meat, Roast, Turkey, or any form of meat
6. Ice, Land, or any solid
7. Stone, Lead, Sinker, Iron, Rock, or anything that would sink
8. Land, Continent, Peninsula
9. Water, Liquid
10. Day
11. Three Wheels
12. Braying, Hee-Hawing
13. Salt Water
14. Candle(s)*

*This analogy was changed to read Oil : Lamp :: Tallow: _____; In the original analogy, Tallow : Candle :: Oil : _____; the relation of composition which was possible made it very difficult to name a fourth term composed of oil.

15. Riding
16. Today
17. Private, Soldier(s), Sailor(s)
18. Employee, Employed, Workman
19. Empire
20. Time, Duration

In each case the response that occurred most frequently is placed first.

5. Cause and Effect

In this test, as in the analogies, the score was the total time required for the twenty responses.

The wide variation in the responses in this test makes it impossible to give a complete list of those responses that were considered satisfactory. To some of the nouns there were given, indeed, as many as 50 different effects that could be considered satisfactory. The following is a list of frequently recurring responses:

Stimuli	Satisfactory Responses	Unsatisfactory Responses
1. Nourishment	Growth, Strength	Food, Good health
2. Fall	Injury, Hurt	Bright foliage, Stumble
3. Education	Knowledge, Culture	School, Study
4. Famine	Hunger, Starvation	Lack of Food, Drouth
5. Honesty	Reward, Happiness	Best policy, Policy
6. Storm	Destruction, Damage	Climate, Weather
7. Drouth	Famine, Destruction	Dry, Rain
8. Evidence	Conviction, Proof	Crime, Convicted
9. Fertility	Crops, Abundance	Good crops, richness
10. Guilt	Punishment, Shame	Prison, Wrong
11. Idleness	Poverty, Failure	Lazy, Unhappy
12. Proposal	Marriage, Acceptance	Accept, Offer
13. Diligence	Success, Reward	Work, Industry
14. Jealousy	Hatred, Unhappiness	Disagreeable, Untrue
15. Falsehood	Punishment, Trouble	Lie, Untruth
16. Quarrel	Fight, Anger	Children, Hard feeling
17. Age	Feebleness, Death	Old, Years
18. Vice	Crime, Death	Unhappy, Unlawful
19. Treason	Punishment, Death	Disloyal, Unpatriotic
20. Tyranny	Revolution, Rebellion	King, Overbearing

To illustrate the large number of possible responses to each noun, the different effects given by approximately 300 University juniors and seniors for the eighteenth noun, Vice, are here listed:

affliction
arrest
city
contamination
corruption
crime
criminal
crooked
cruelty
damnation
death
degeneration
degredation
depravity
destruction
disaster
disease
disgrace
disrespect
drink
drunk men
drunkenness
emptiness
enemies
evil
extra
fear
fool
gambling
guilt
heartache
horror
ignorance
ill-health
ill-will
immoral
immorality
imprisonment
injury
innocence
insult
investigation
jail
lawlessness
laziness
loathing
lost
mean
misbehavior
misdemeanor
misfortune
misery
monster
murder
nervousness
ostracism
pain
pauperism
poverty
prison
punishment
quarrel
red light
reform
regret
regulation
report
results
ruin
saloon
scorn
sickness
sin
sorrow
stupor
suffering
theft
trouble
ugliness
uncleanliness
unhappy
unhappiness
unlawful
viciousness
wicked
wickedness
woe
worthlessness
wretchedness
wrong

The fact that such a wide range of responses was possible made it difficult to score accurately. This difficulty was obviated in part by requiring the student to try again if he gave a response that was obviously incorrect or doubtful. Three trials were allowed. The time required for the correct response was recorded. Thirty seconds was the maximum time allowed. When no correct response was given within this period, the time was recorded as 30 seconds.

6. Directions Test

In scoring this test the same formula was used that was used in the cancellation test, $E = \frac{A}{T}$, where E is efficiency, A is accuracy, (100% less 5% for each error) and T is time in seconds.

From 10 to 15 papers from each class were thrown out because the students misinterpreted the directions, with your pencil make a dot over any one of the following letters F G H T J. They interpreted this to mean to place a dot over one of those letters wherever it occurred in the entire sheet.

7. Word-Building Test

The score in this test was the total number of words formed in both the aeobmt-test and the eairlp-test. For a description of the scoring see Whipple's Manual, Test 47.

In spite of the fact that the instructions were read twice and an opportunity given for asking questions, several students were discovered as we walked about the room, who did not understand the instructions. For example, some were using letters that were not in the list of 6 letters; others were using a letter twice in the same word. A few who were discovered early in the test received individual help. Some papers were thrown out where instructions were not followed.

RESULTS

In Tables I to IV* are presented the age and the score of each individual in each of the tests taken, with the decile in which each score falls. Since in many cases the average for the twenty responses in the analogies test and the cause and effect test is so different from the median, the medians are here given.

In Table V* are given the scores according to age and year in the high school. The facts of this table will be discussed under age-differences.

The percentile scores in each of the seven tests are presented in Graphs 1 to 35 according to age, sex, and year in the high school. In the percentile graphs the ordinates are the scores in each test and the abscissae are the percentiles.

Year in High School

Graph 1 shows the scores in the cancellation test for high-school freshmen, sophomores, juniors and seniors. Eighty per cent of the seniors are above the median score of the sophomores. It is not clear why the freshmen should make a better record than the sophomores; almost 60 per cent of the freshmen are above the median score of the sophomores. The range of efficiency of classes is relatively small. This test does not show the marked difference between the first two years and the last two years, which is present in the tests that show a high correlation with general intelligence.

Graphs 2 and 3 show the scores for the two memory tests;

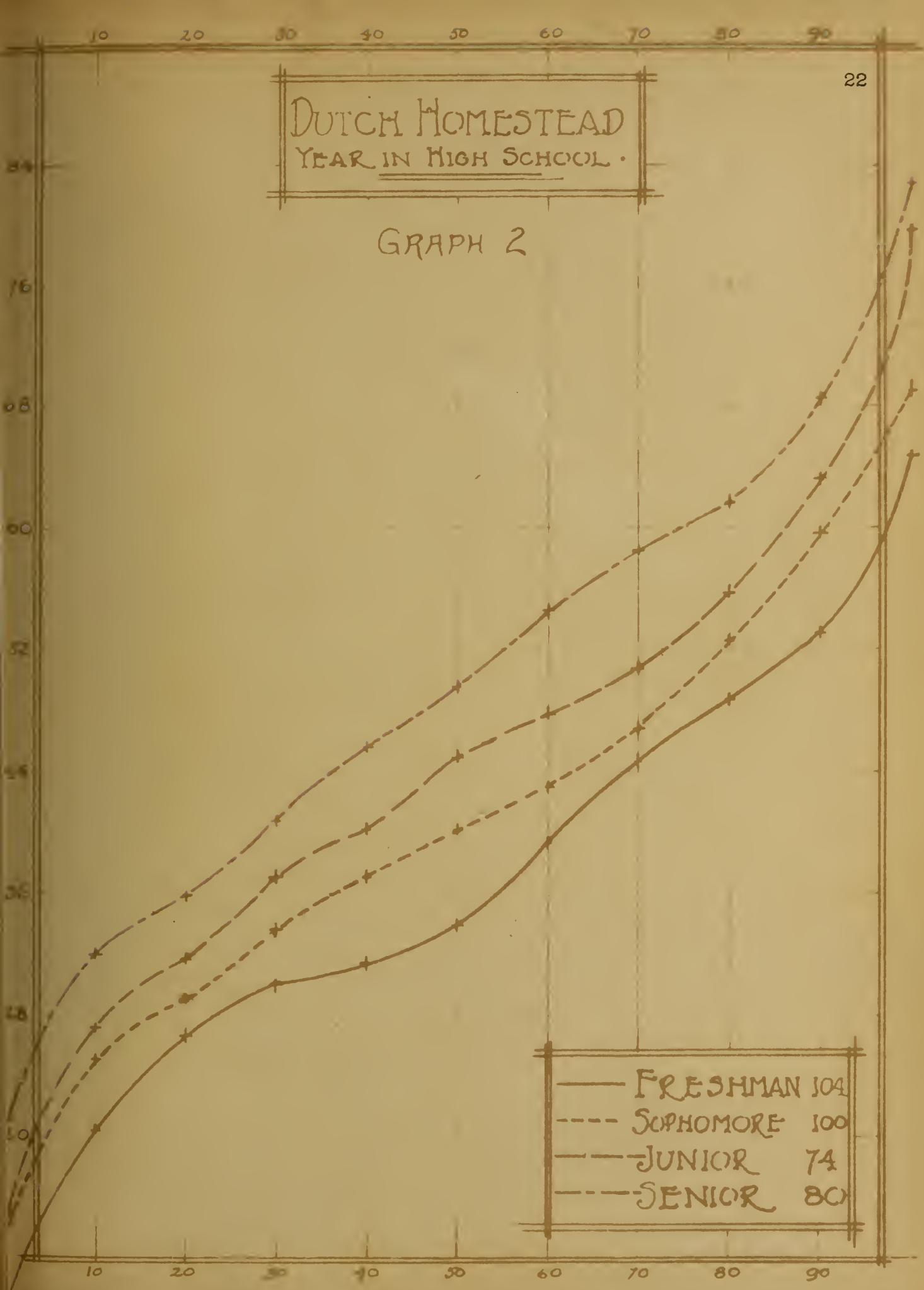
*See Appendix.

CANCELLATION
YEAR IN HIGH SCHOOL

- GRAPH 1 -

DUTCH HOMESTEAD
YEAR IN HIGH SCHOOL.

GRAPH 2



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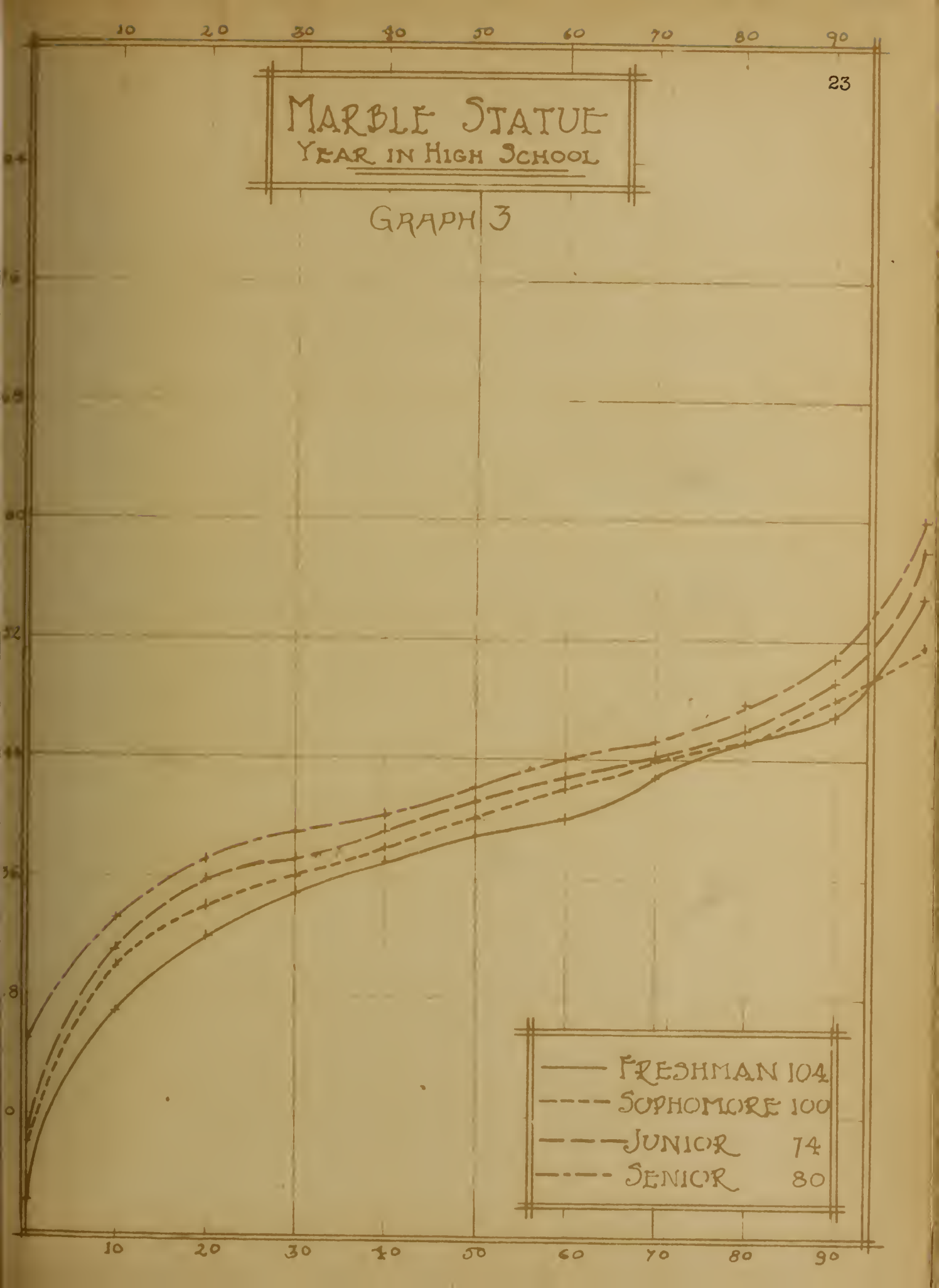
YEAR IN HIGH SCHOOL

GRAPH 3



the former is visual memory and the latter is auditory memory. There is a similarity in the general shape of the graphs but the range is much greater in the visual memory test and the difference between the different years is also greater. In the visual memory more than 80 per cent of the seniors are above the median score of the freshmen. In the auditory memory test only 70 per cent of the seniors are above the median score of the freshmen. There is a gradual increase in efficiency from the freshmen to the senior year in both of these tests. Neither of these tests shows the marked difference between the sophomore and the junior years that is present in the analogies, the cause and effect and the word-building tests.

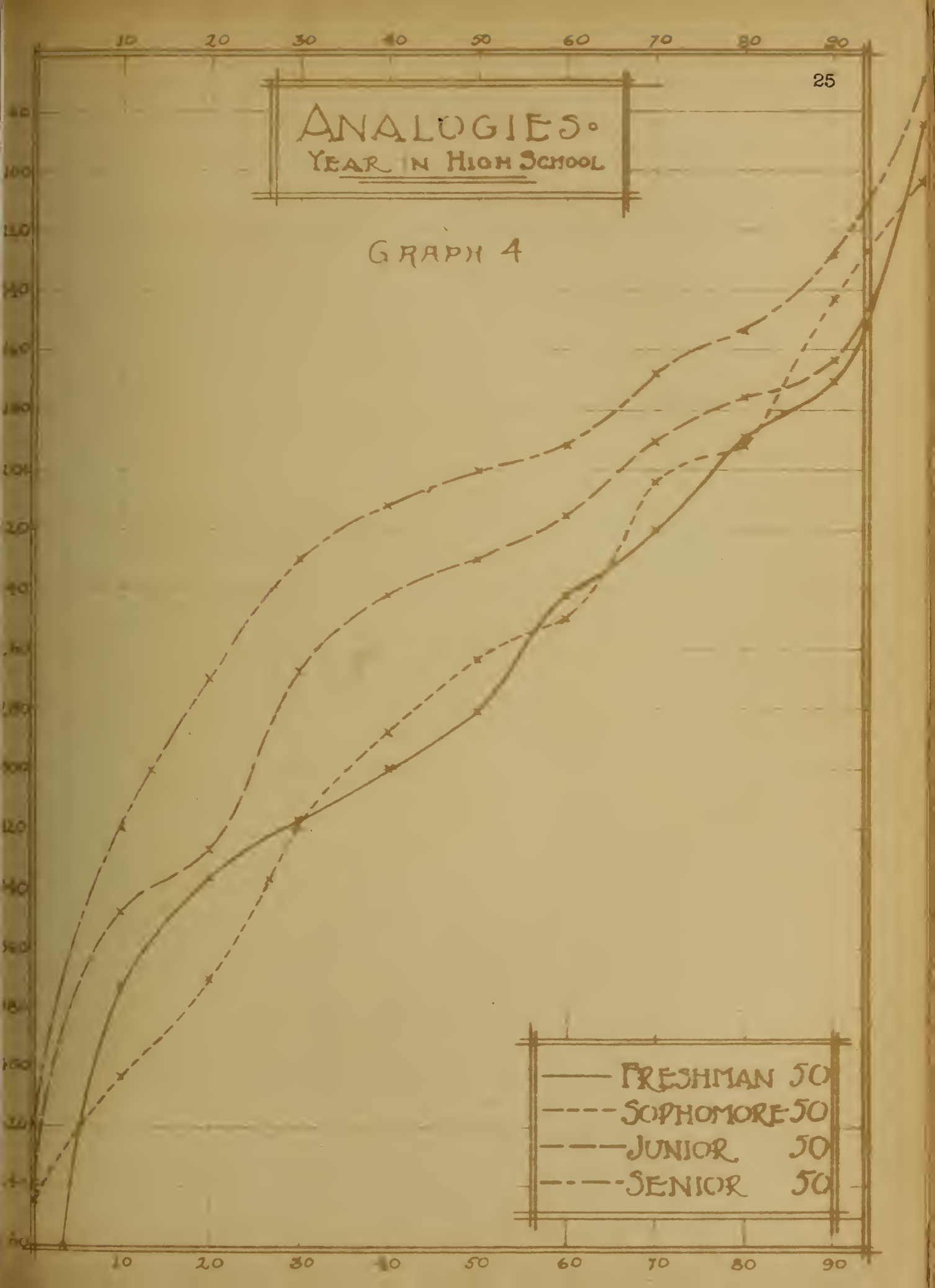
The author is of the opinion that the Dutch Homestead does not measure visual memory alone. The recall of the material was dependent upon the impression received during the three minutes the students read the paragraph. This in turn was dependent upon the ability of the students to utilize effectively the three minutes for memorizing the paragraph. When the test was given, one could see that the advanced students were able to study the paragraph more effectively. By virtue of this fact they got a better impression, and they would, therefore, have more to recall. Ability to read rapidly and carefully would contribute to better recall.

In the Marble Statue, where the material was presented orally, the chance of all students getting the same impression was greater. This probably accounts for the fact that the difference between the freshman and the senior scores in the Marble Statue is less than the difference between the same scores in the Dutch Homestead.

Graphs 4, 5, 6, and 7 are similar in that the marked dif-

ANALOGIES.
YEAR IN HIGH SCHOOL

GRAPH 4

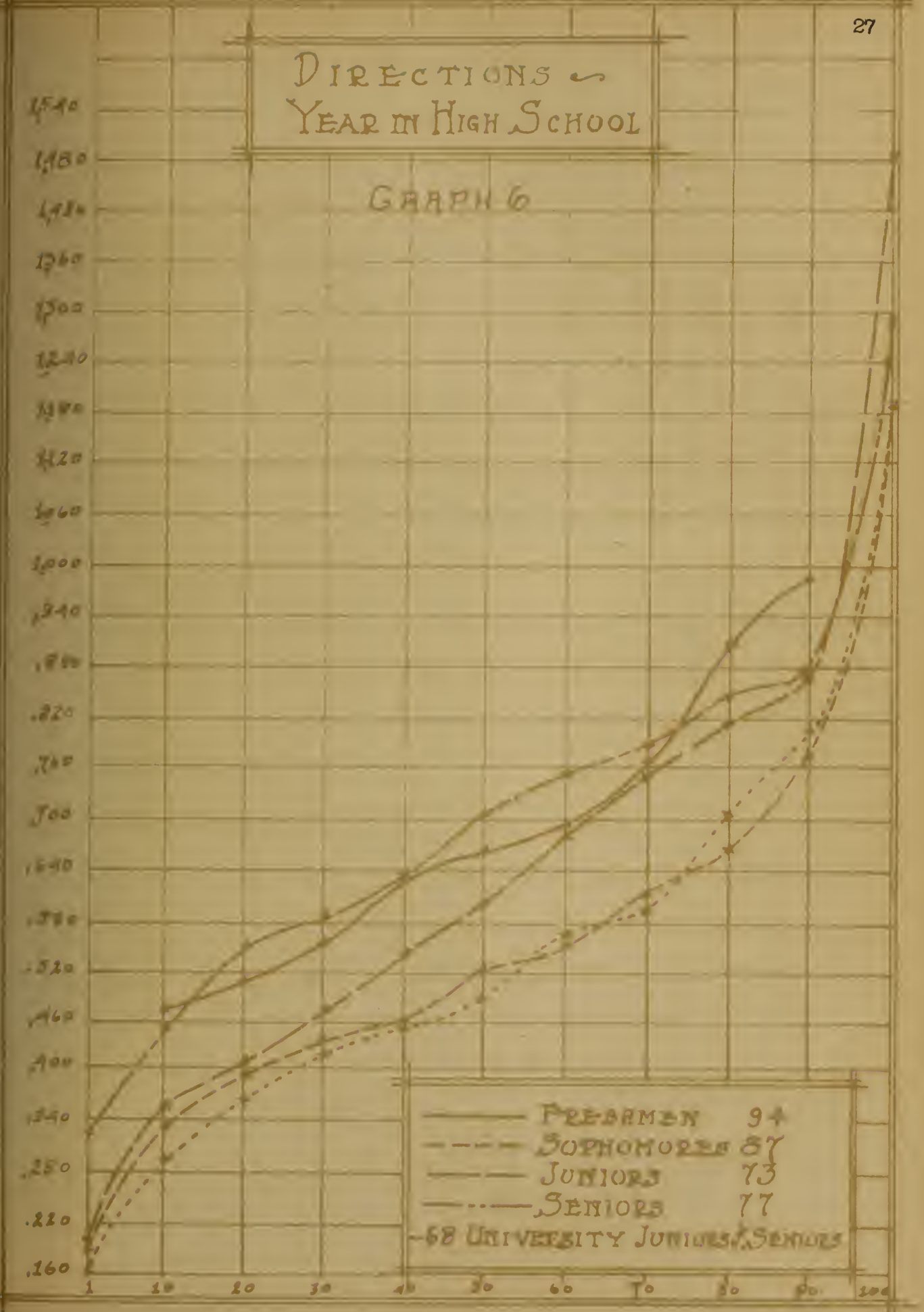


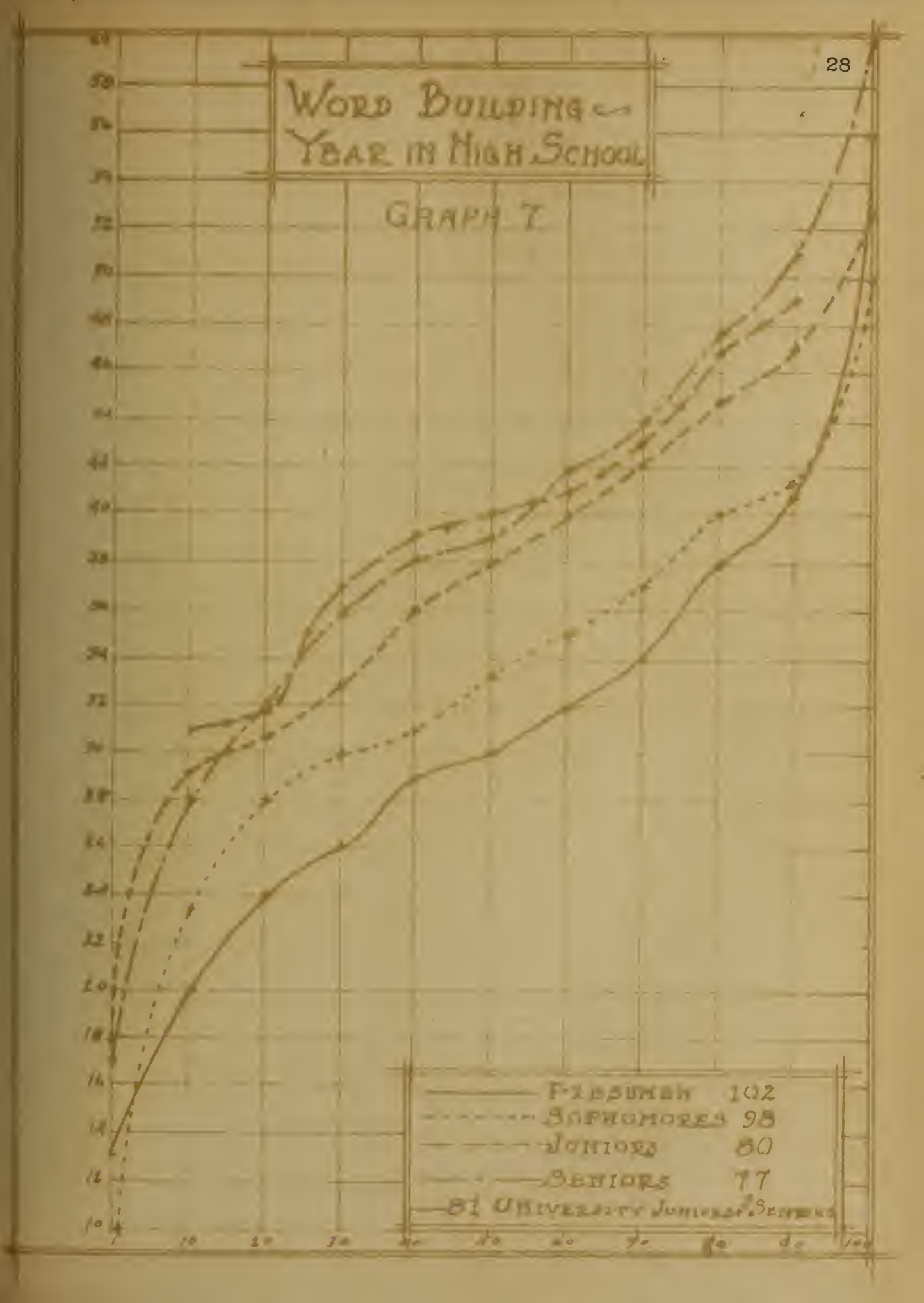
CAUSE and EFFECT
YEAR IN HIGH SCHOOL

GRAPH 5

DIRECTIONS ~ YEAR IN HIGH SCHOOL

GRAPH 6




WORD BUILDING
YEAR IN HIGH SCHOOL
GRAPH I
FRESHMEN 102
SOPHOMORES 98
JUNIORS 80
SENIORS 77
81 UNIVERSITY JUNIORS & SENIORS

ference between the sophomore and junior years is present in each test. The elimination of the less capable students at the end of the sophomore year probably explains this difference, since the graphs 18 to 28 for the different ages do not show that age is responsible for it. Graphs 29 to 35 show that the older students in the freshman and sophomore classes do no better than the younger students in the same classes. In the analogies test, Graph 32, the older students are much less efficient than the younger students in the freshman and sophomore classes. In both of these years it is the over-age students that are eliminated. The more capable and the younger students continue through the junior and senior years. This is evidenced by the fact that the advanced classes are a more homogeneous group in regard to age and by the fact that the scores of the advanced group are higher.

The facts do not favor the conclusion that there is a sudden development of any of the abilities tested between the first two years and the last two years of the high school, even though in Tests 4, 5, 6, and 7 there is a marked superiority of the scores of the two upper classes over those of the two lower classes.

Sex-Differences

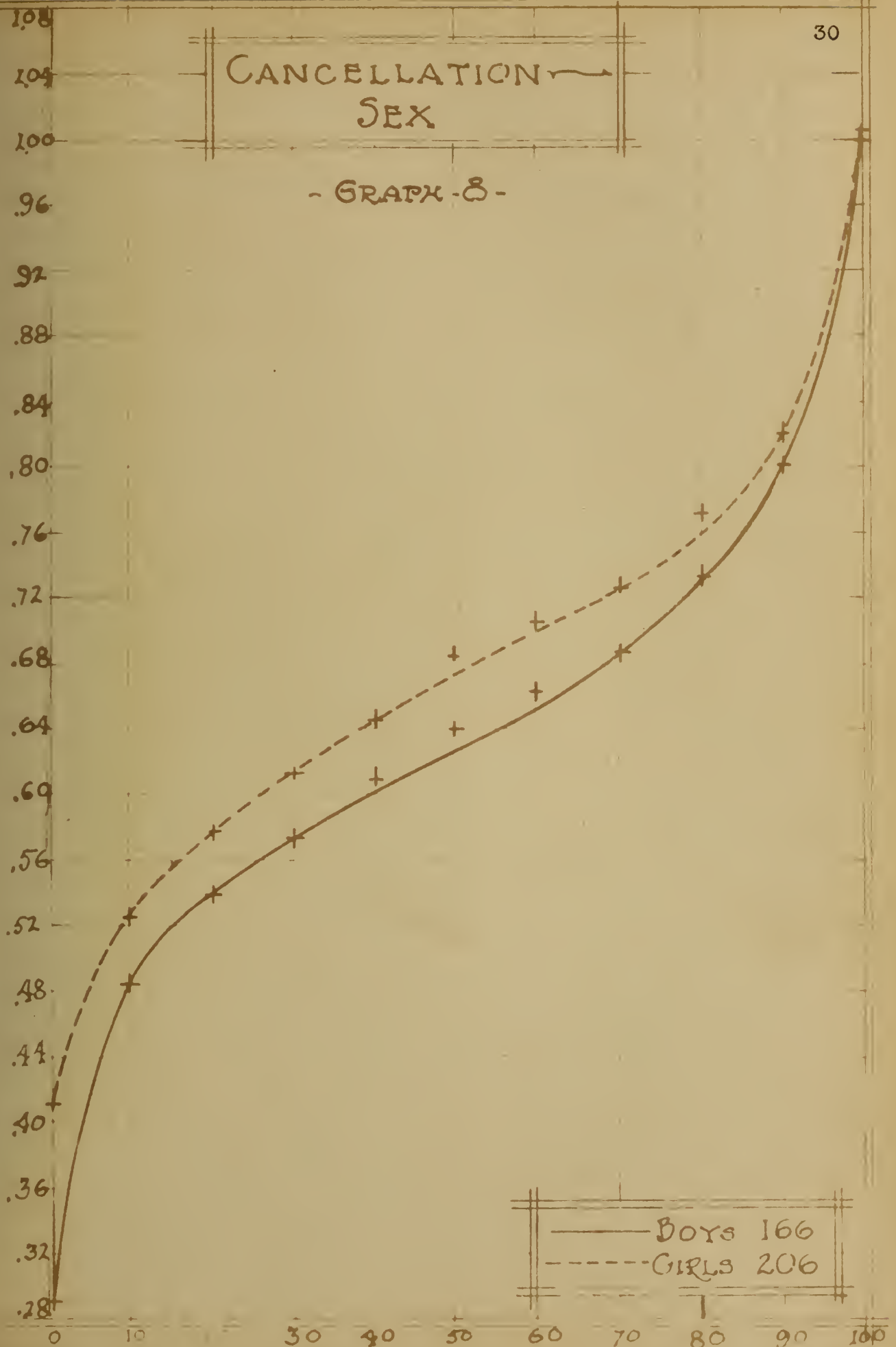
Graphs 8 to 14 show the sex-differences in the seven tests. In all except the analogies and cause and effect tests the girls are better than the boys, though the difference is not great.

In cancellation, Graph 8, approximately 60 per cent of the girls are above the median score of the boys.

In the Dutch Homestead, Graph 9, the medians for the sexes are almost identical, but in the upper 50 per cent the scores of

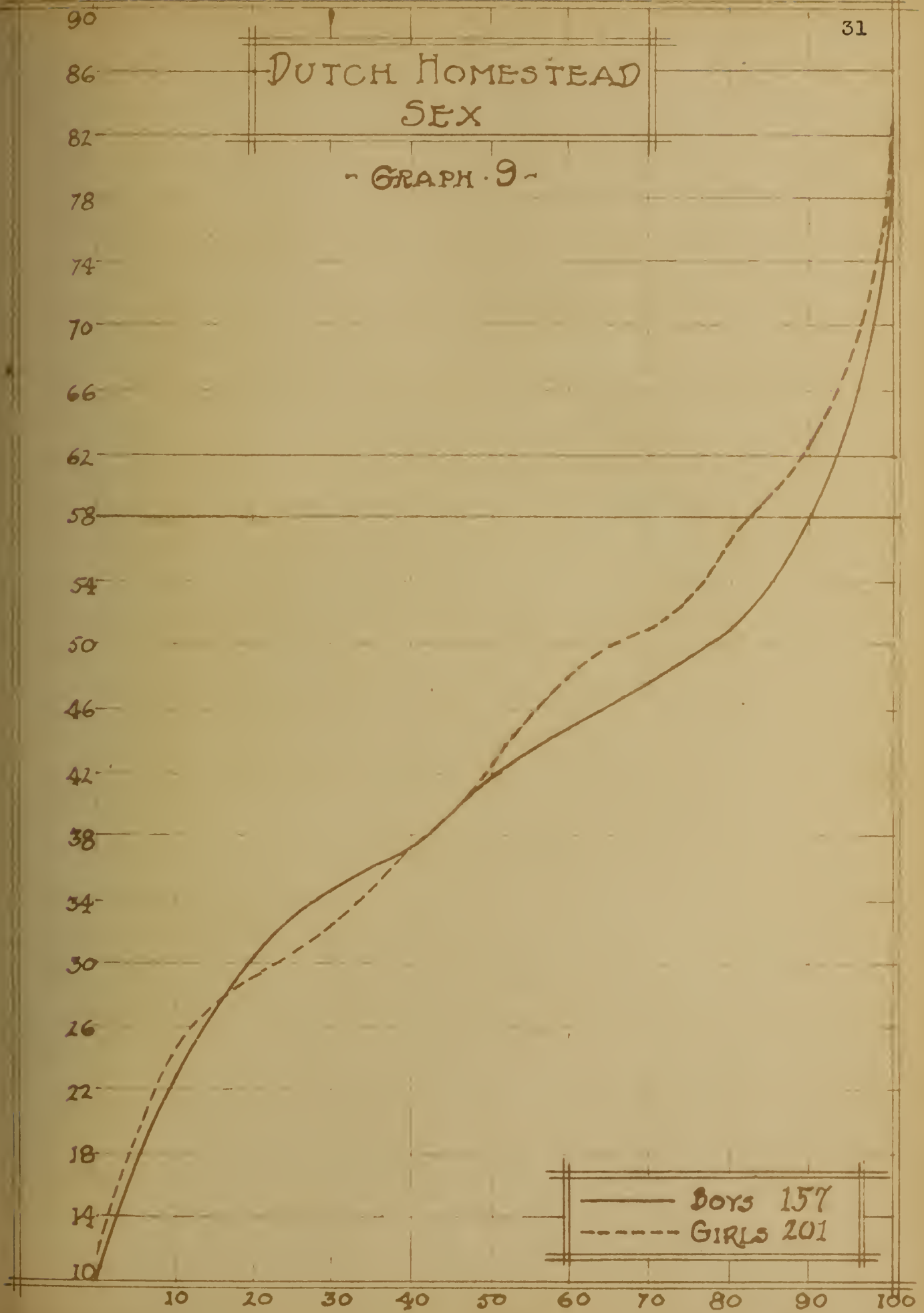
CANCELLATION
SEX

- GRAPH -8-



DUTCH HOMESTEAD
SEX

- GRAPH 9 -



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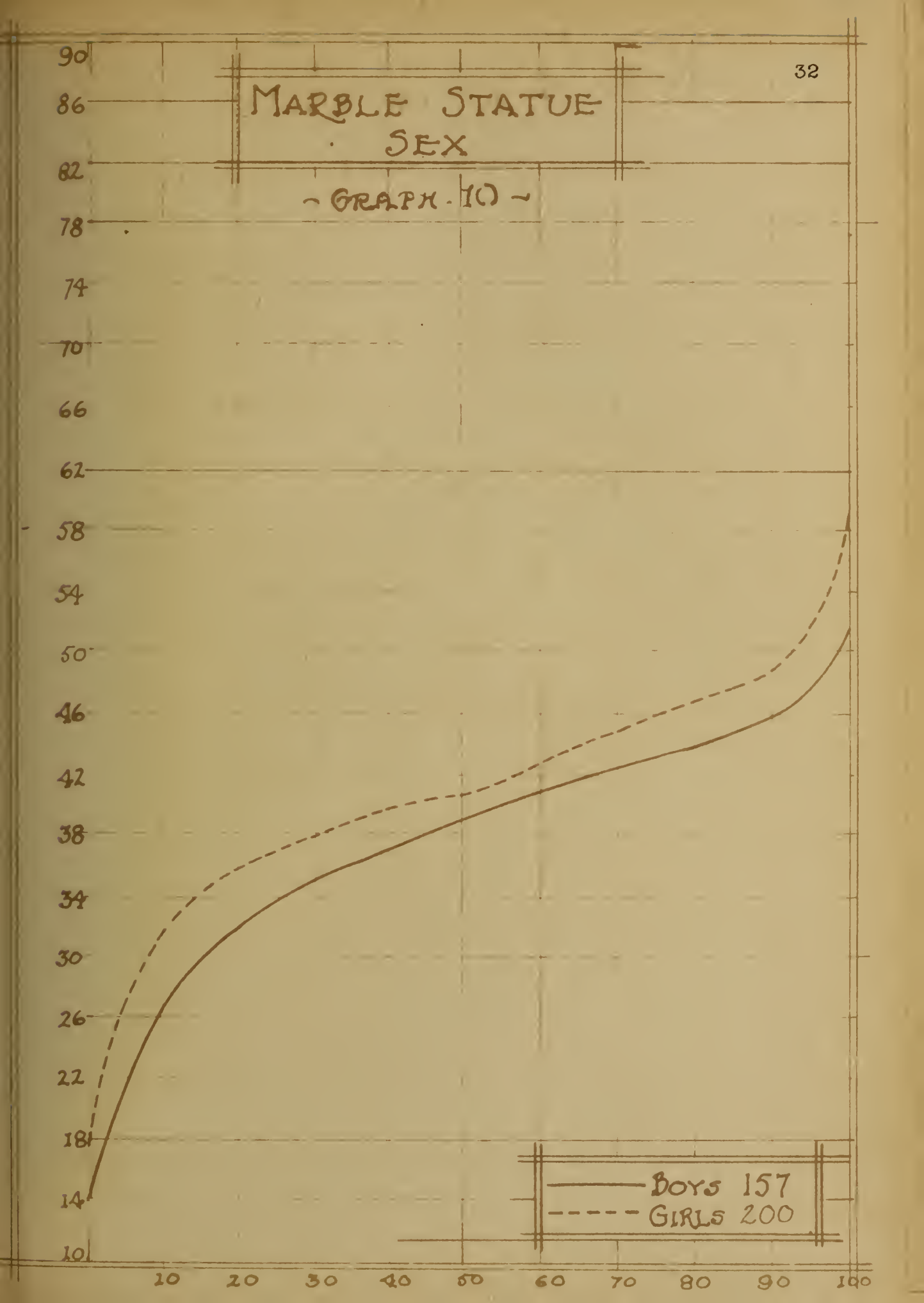
MARBLE STATUE
SEX

~ GRAPH 10 ~



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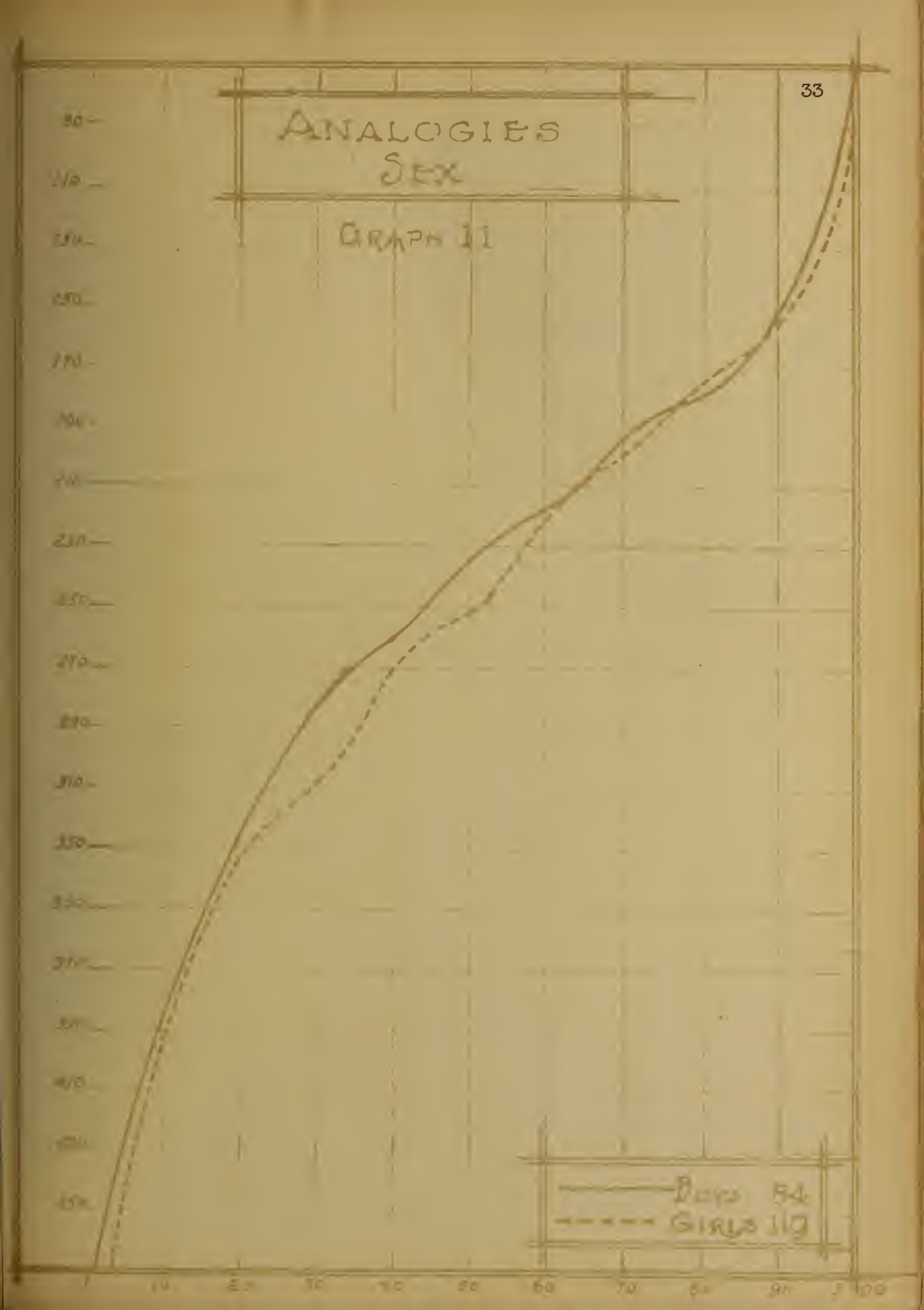
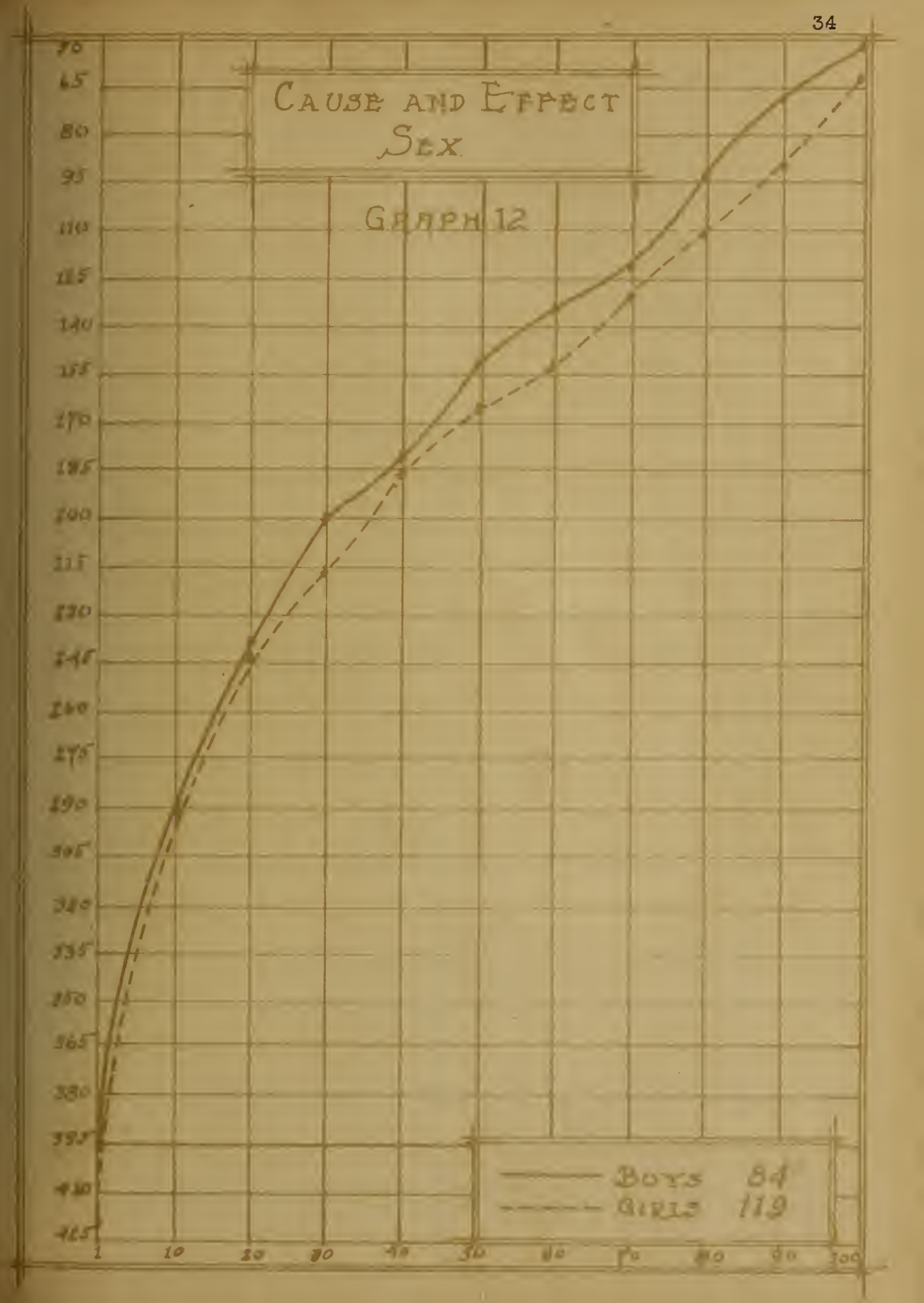
ANALOGIES
SEX

GRAPH 11

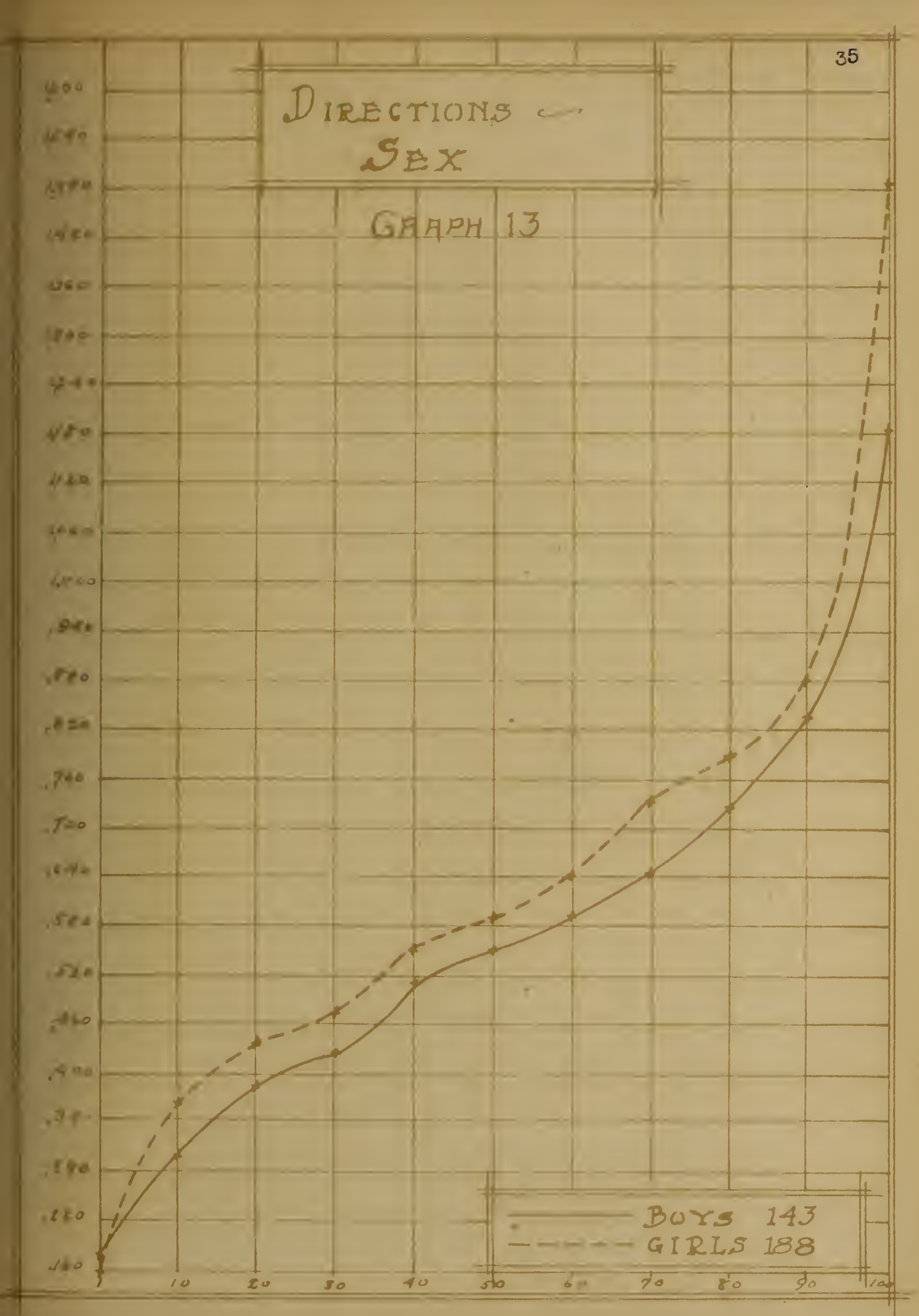


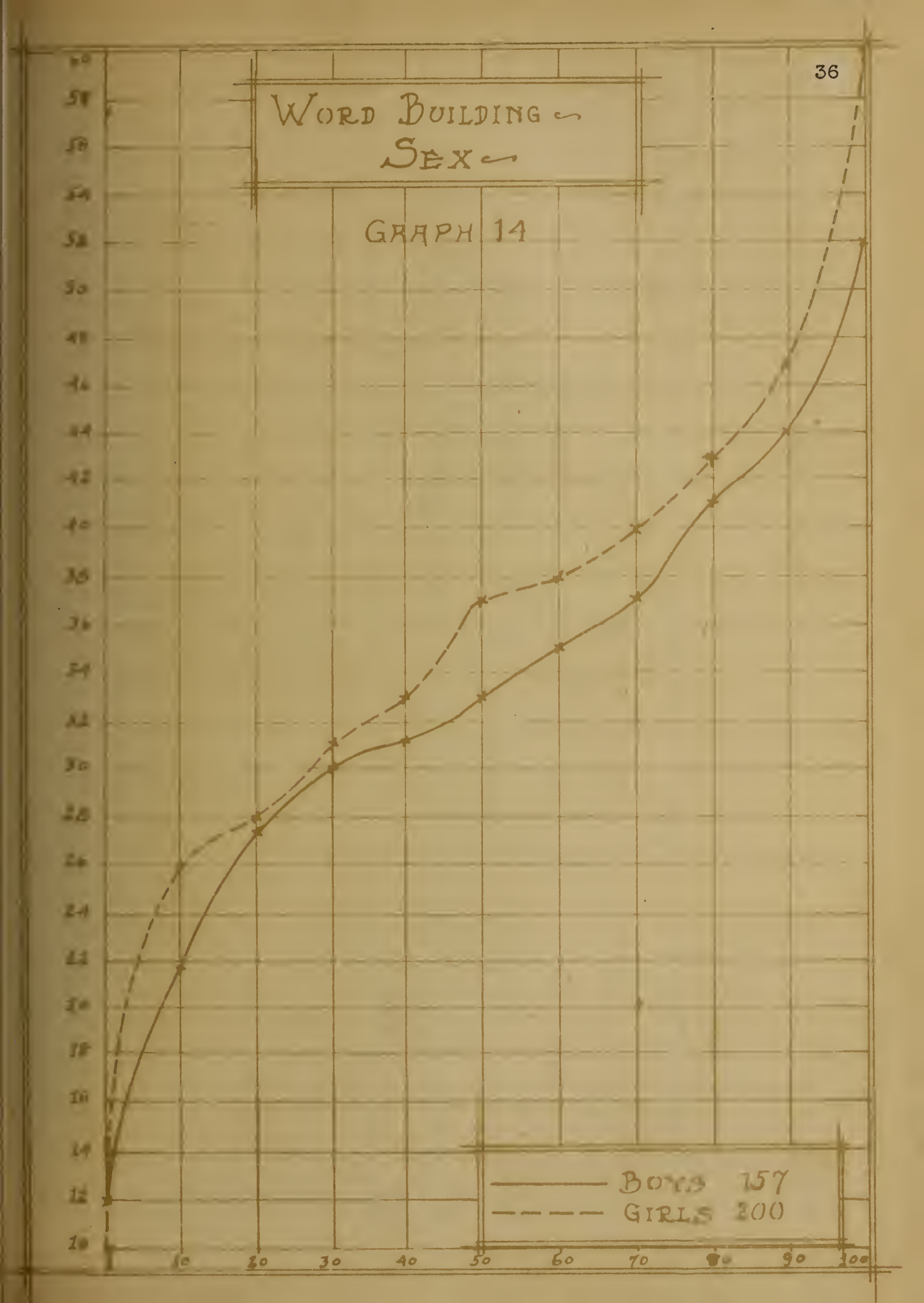
OF THE


CAUSE AND EFFECT
SEX
GRAPH 12
Boys 84
Girls 119
1
10
20
30
40
50
60
70
80
90
100

DIRECTIONS
SEX

GRAPH 13




WORD BUILDING ~
SEX ~
GRAPH 14
BOYS 157
GIRLS 200
10
20
30
40
50
60
70
80
90
100

the girls are higher.

In the Marble Statue, Graph 10, approximately 65 per cent of the girls are above the median score of the boys.

In the analogies test, Graph 11, almost 60 per cent of the boys are above the median score of the girls, but there is practically no sex-difference in the upper 50 per cent. In the lower 50 per cent the girls are at each decile poorer than the boys.

In the cause and effect test, Graph 12, the boys are better than the girls; about 55 per cent of the boys are above the median score of the girls. The sex-difference is greater in the upper 50 per cent.

Slightly more than 60 per cent of the girls are above the median score of the boys in the directions test, Graph 13.

Sixty per cent of the girls are above the median score of the boys in the word building test, Graph 14.

The results warrant the general conclusion that the sex-differences in all of the abilities tested are not great enough to explain sex-differences in performance in high-school subjects where these exist.

Age-Differences

Graphs 15 to 21 show the age-differences without regard to the year in the high school. Under this treatment the differences due to age are not consistent, that is, the efficiency does not vary regularly with age. All that can be said is that, in general, the group of students 17, 18 and 19 years of age does better than the group 14, 15 and 16 years of age.

But a classification on the basis of age and year in high school, Graphs 22 to 35 together with Table V,* enables one to make

*See Appendix.

the following generalizations:

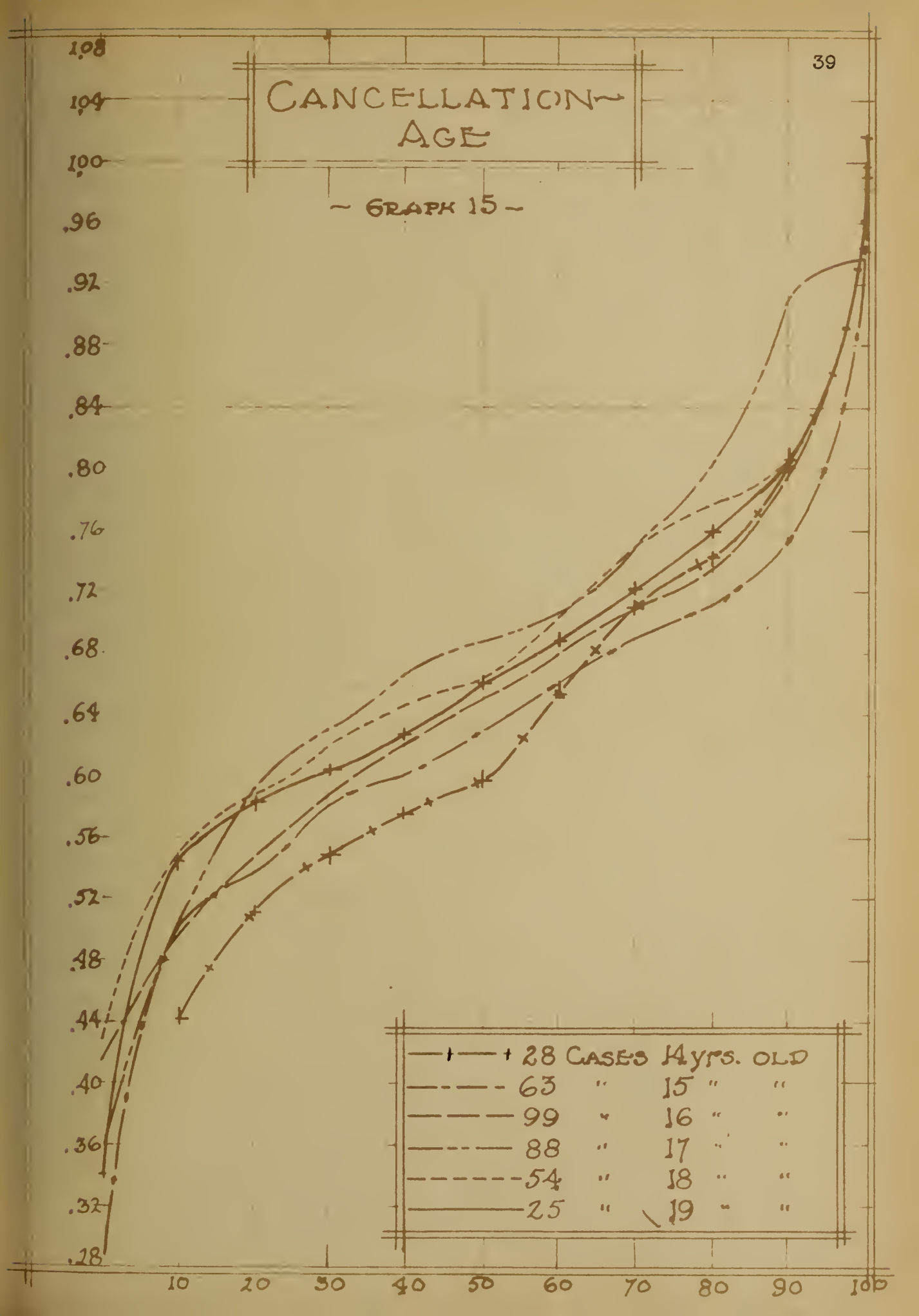
1. In any one year in the high school the younger students excel.

2. With students of any given age those more advanced in the high school are more efficient in the tests.

These generalizations are supported by the results of investigations that have been made in regard to age of high-school students, and their performance in high-school subjects as measured by school marks.

CANCELLATION~ AGE

~ GRAPH 15 ~



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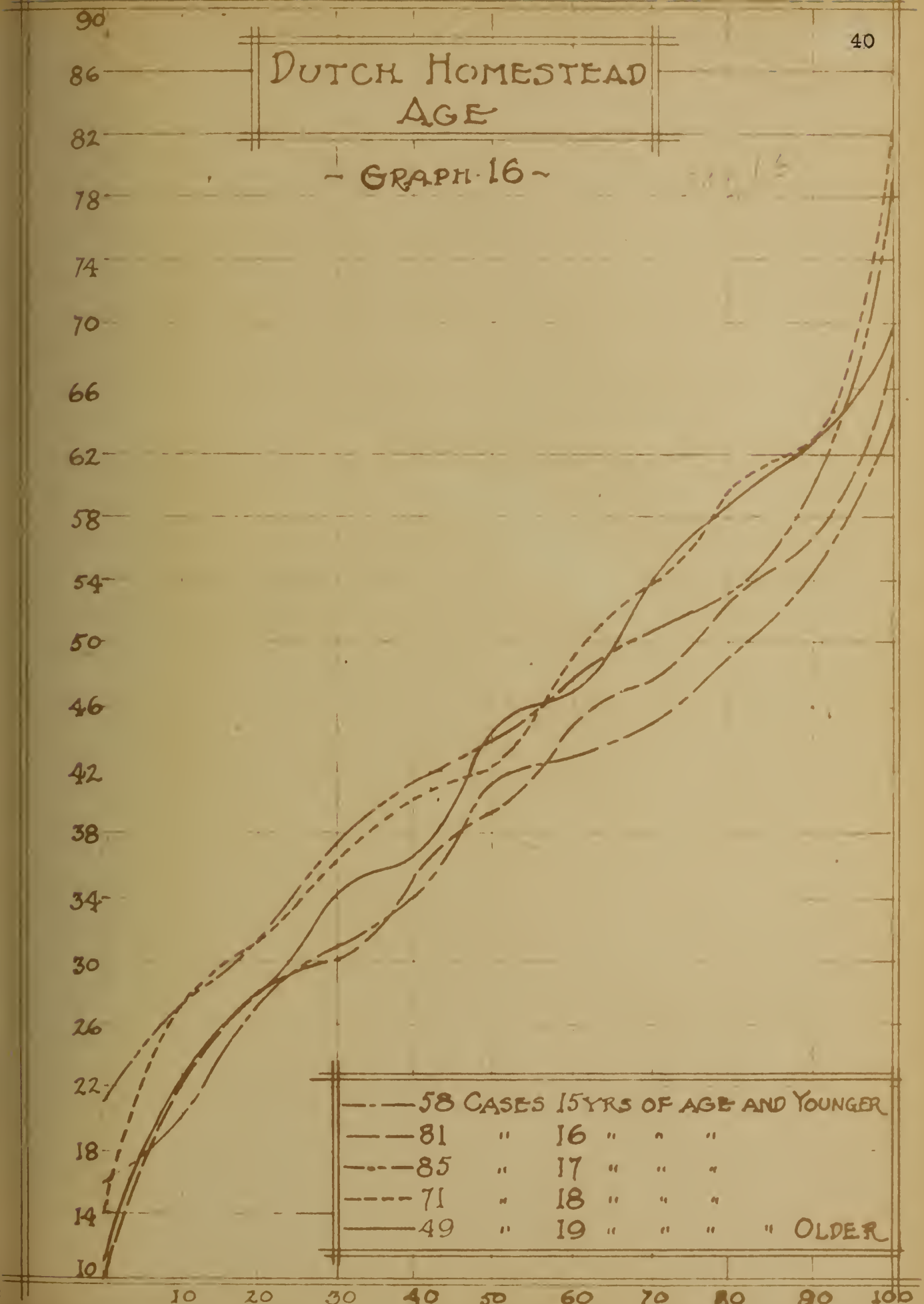
DUTCH HOMESTEAD AGE

~ GRAPH 16 ~



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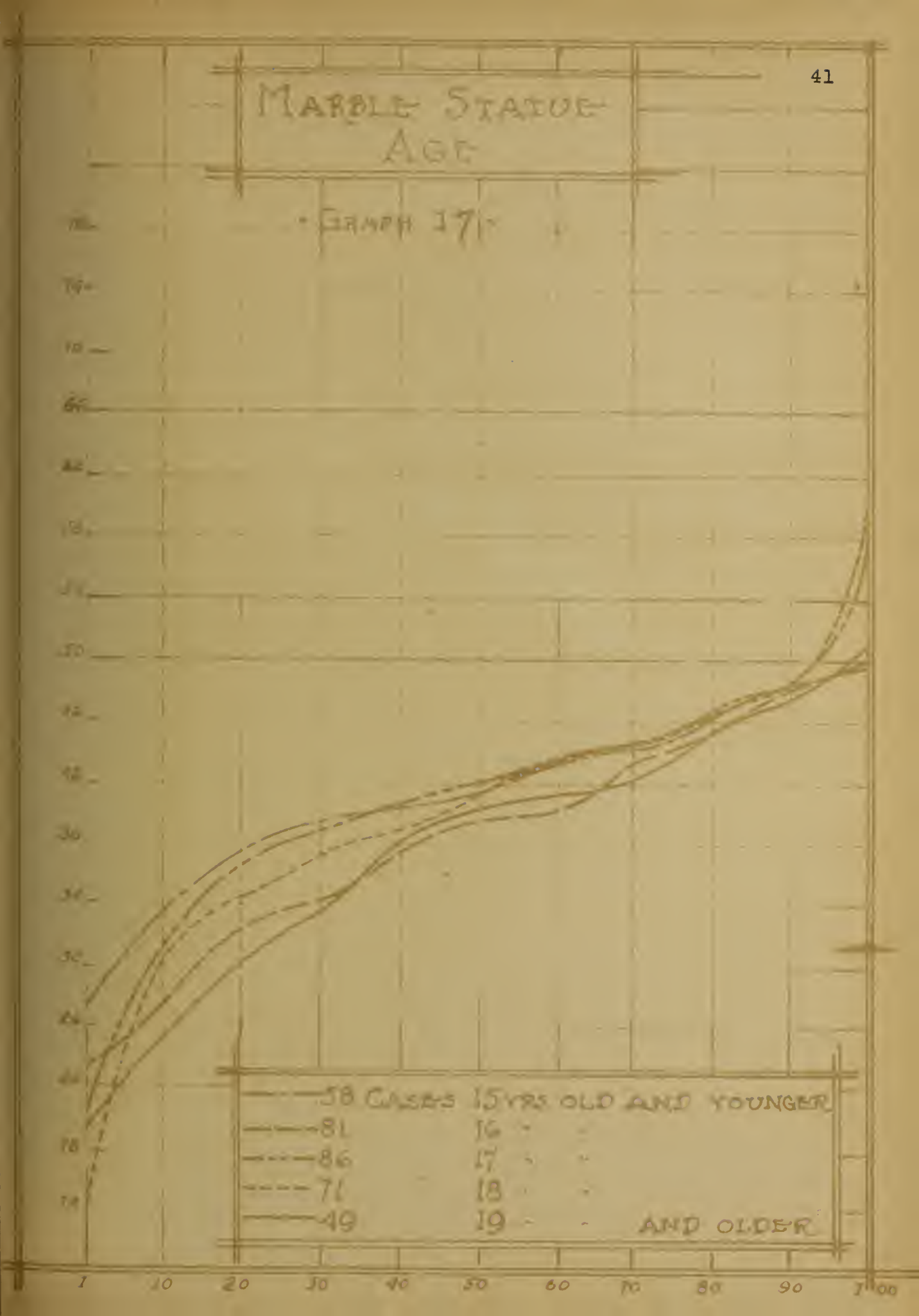
MARBLE STATUE AGE

GRAPH 17



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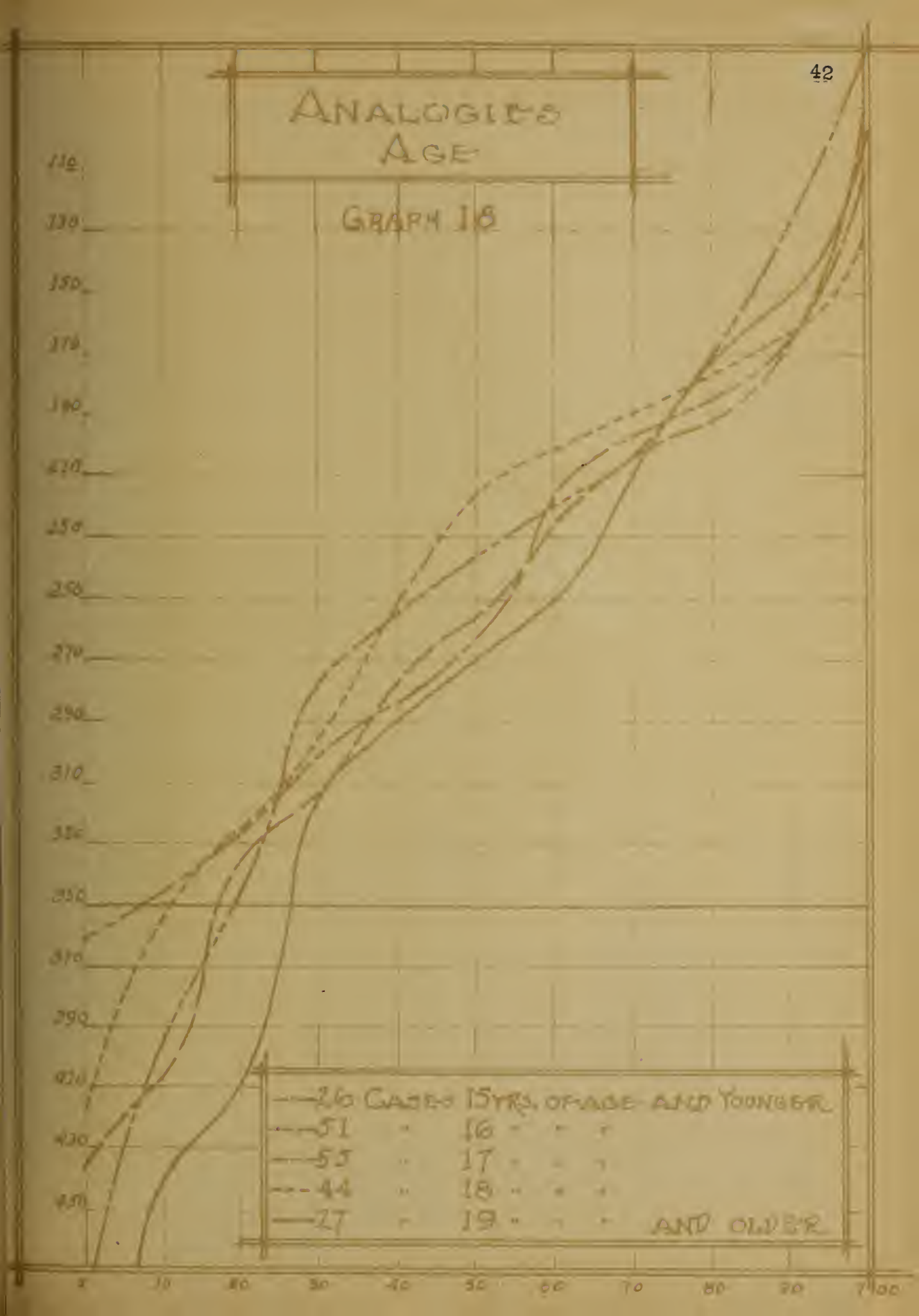
ANALOGIES
AGE

GRAPH 18



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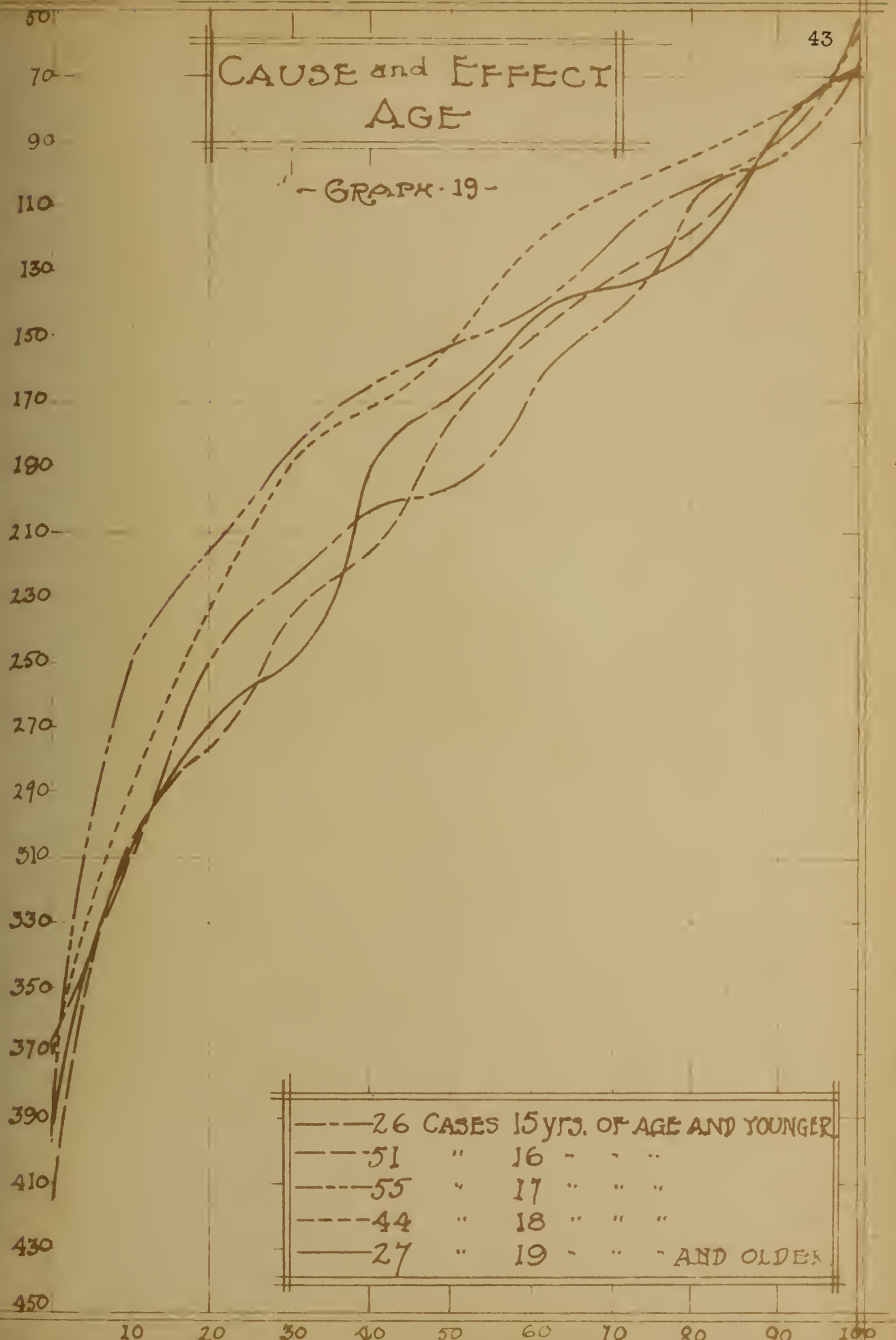
CAUSE and EFFECT
AGE

- GRAPH · 19 -



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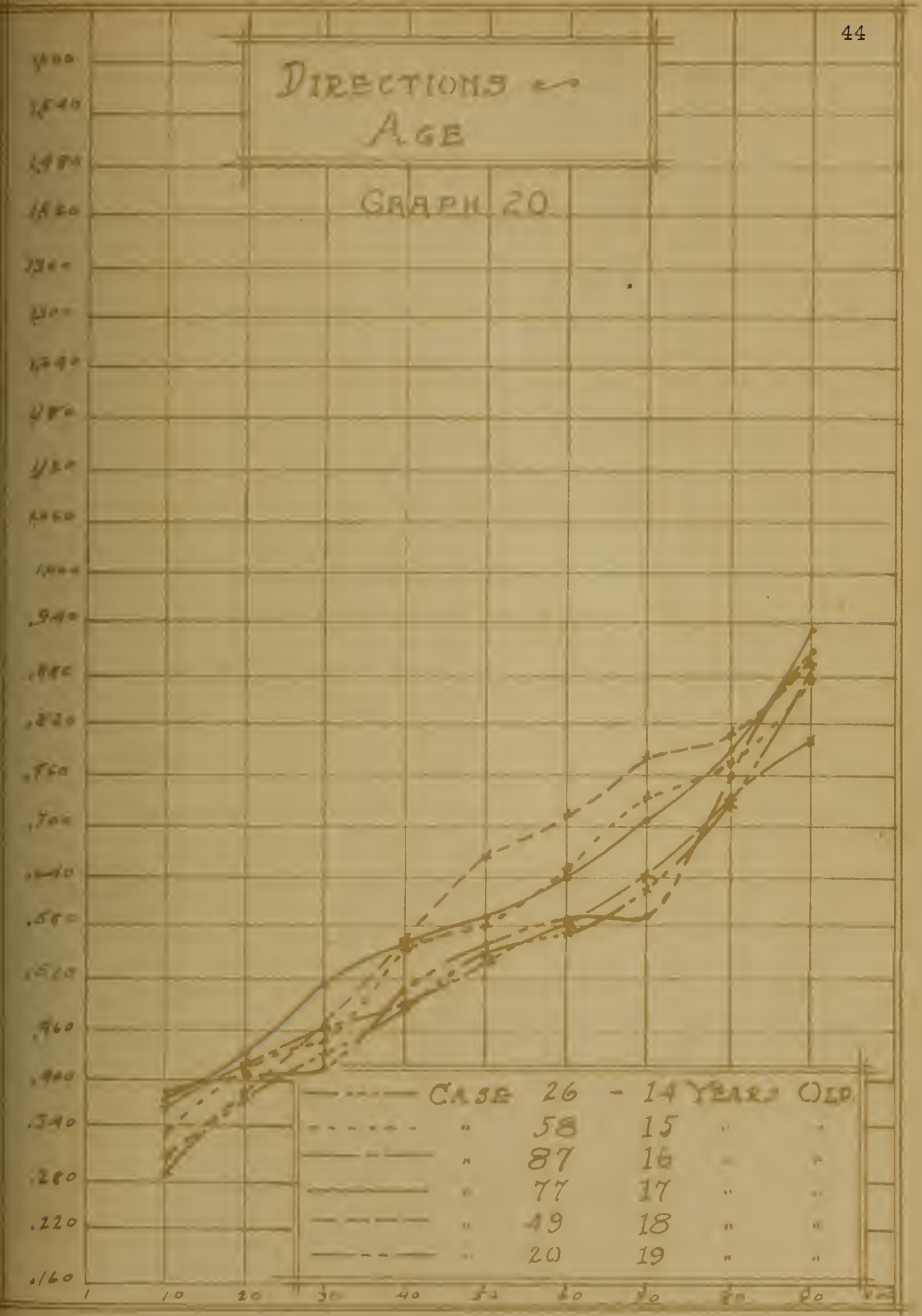
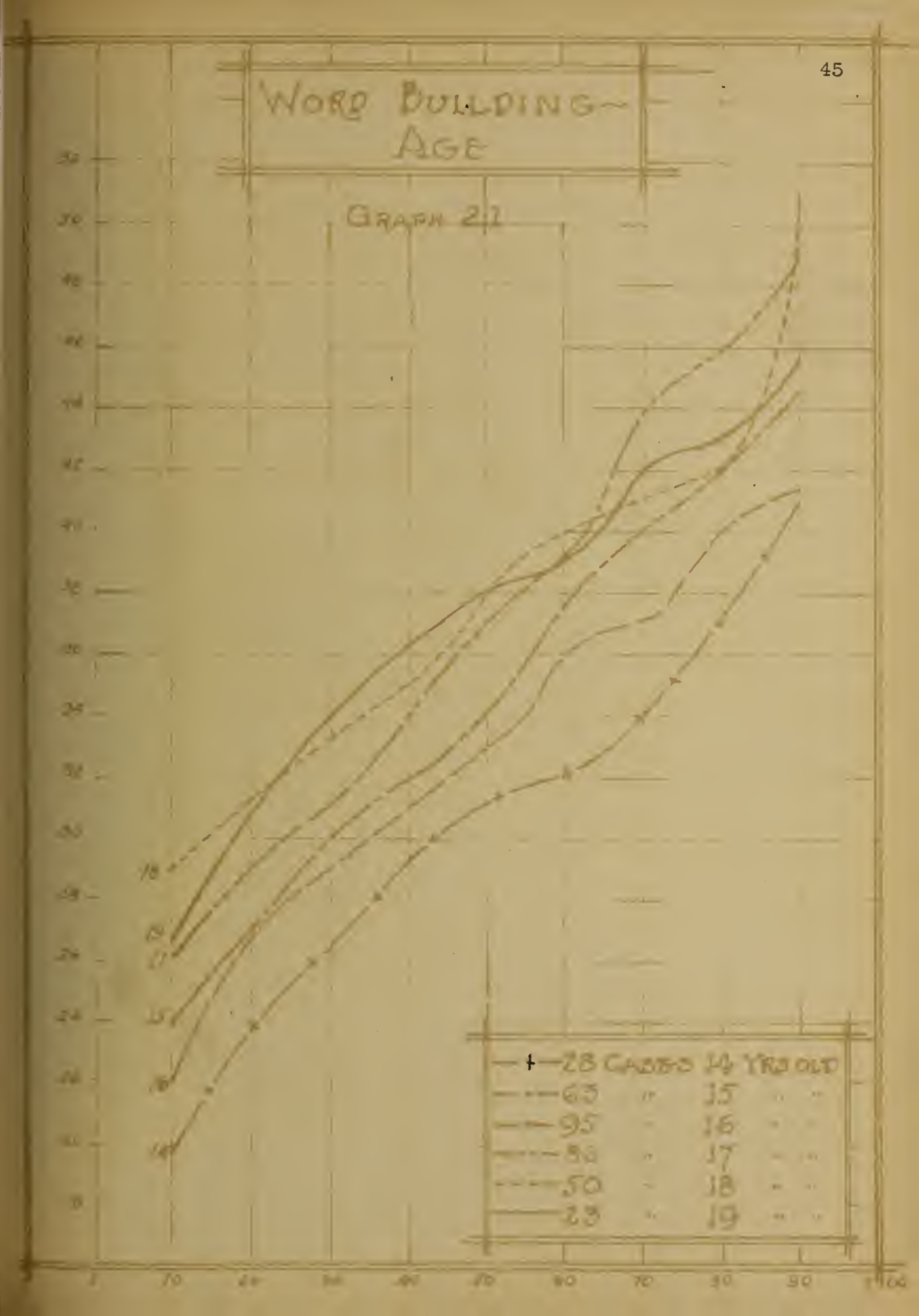
DIRECTIONS ~ AGE

GRAPH 20



WORD BUILDING — AGE

GRAPH 21



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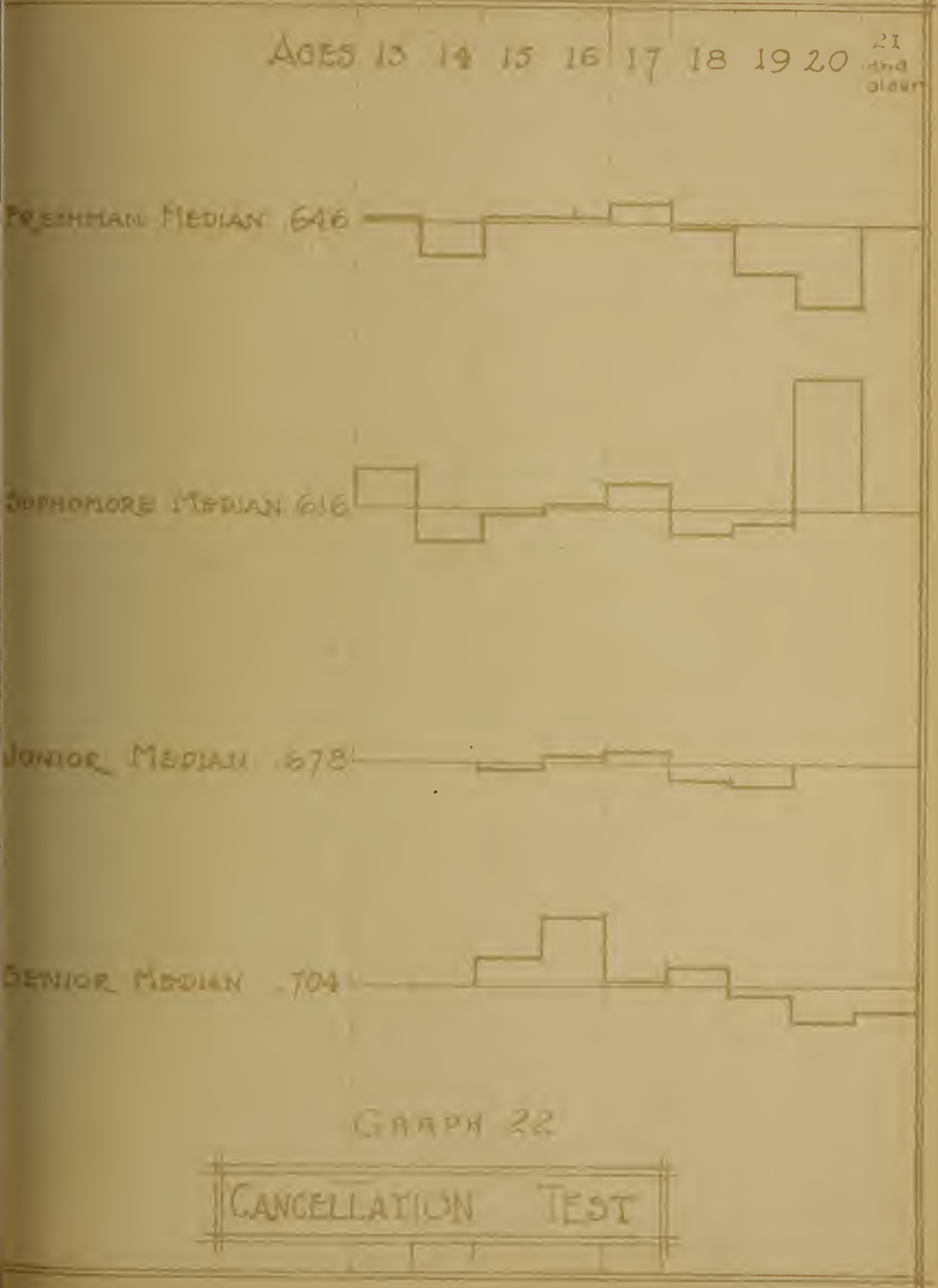
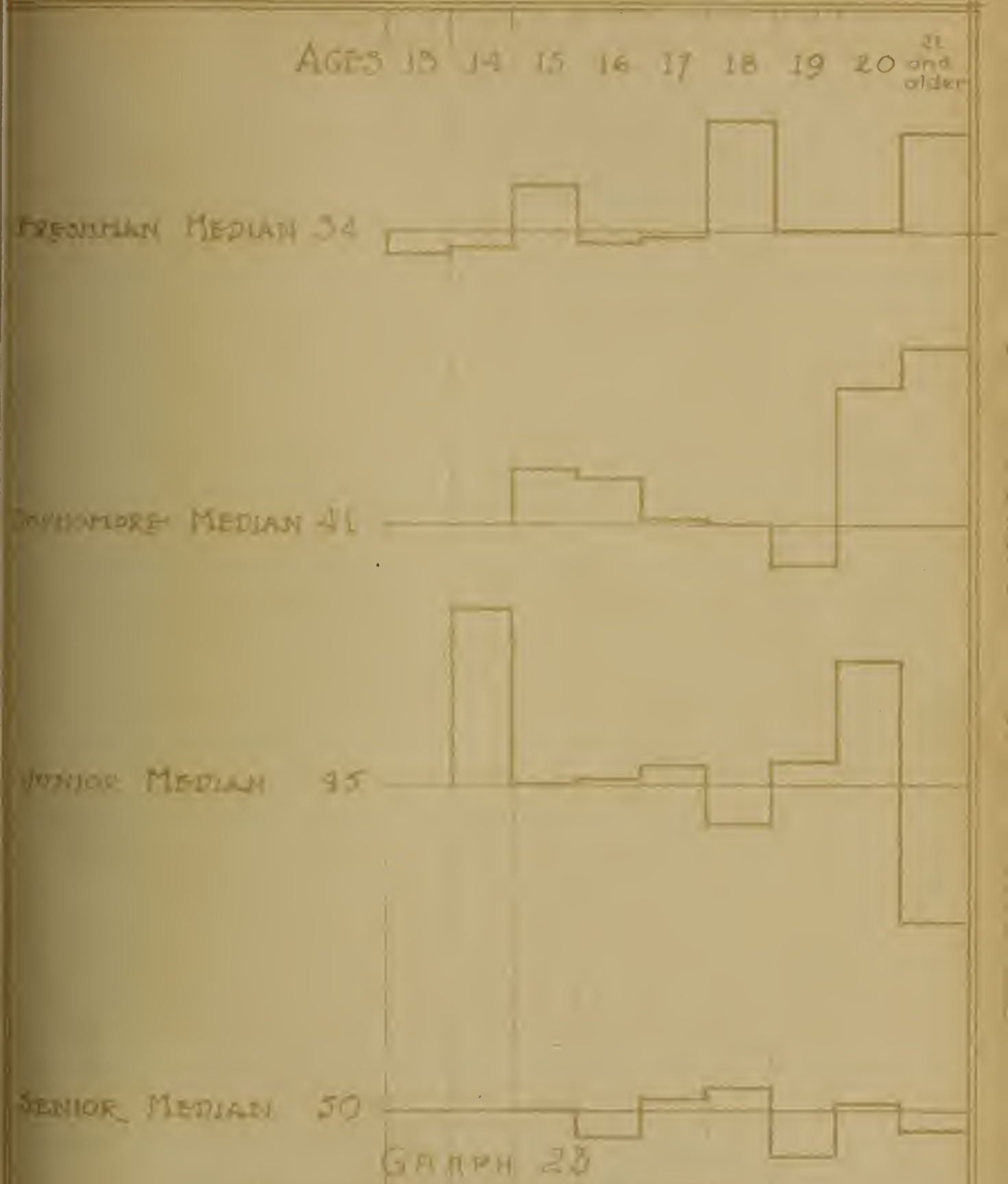


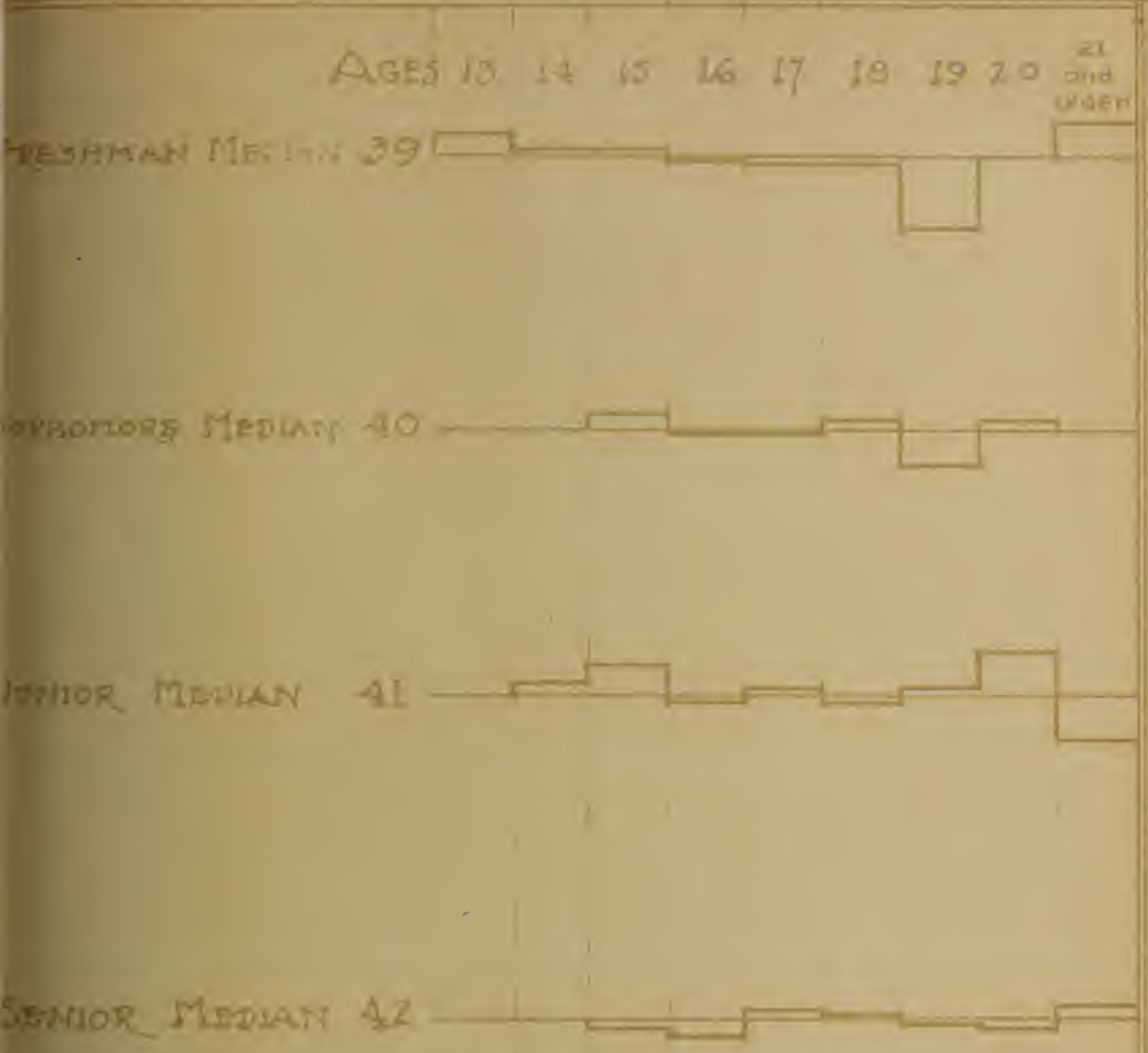
GRAPH 22

CANCELLATION TEST



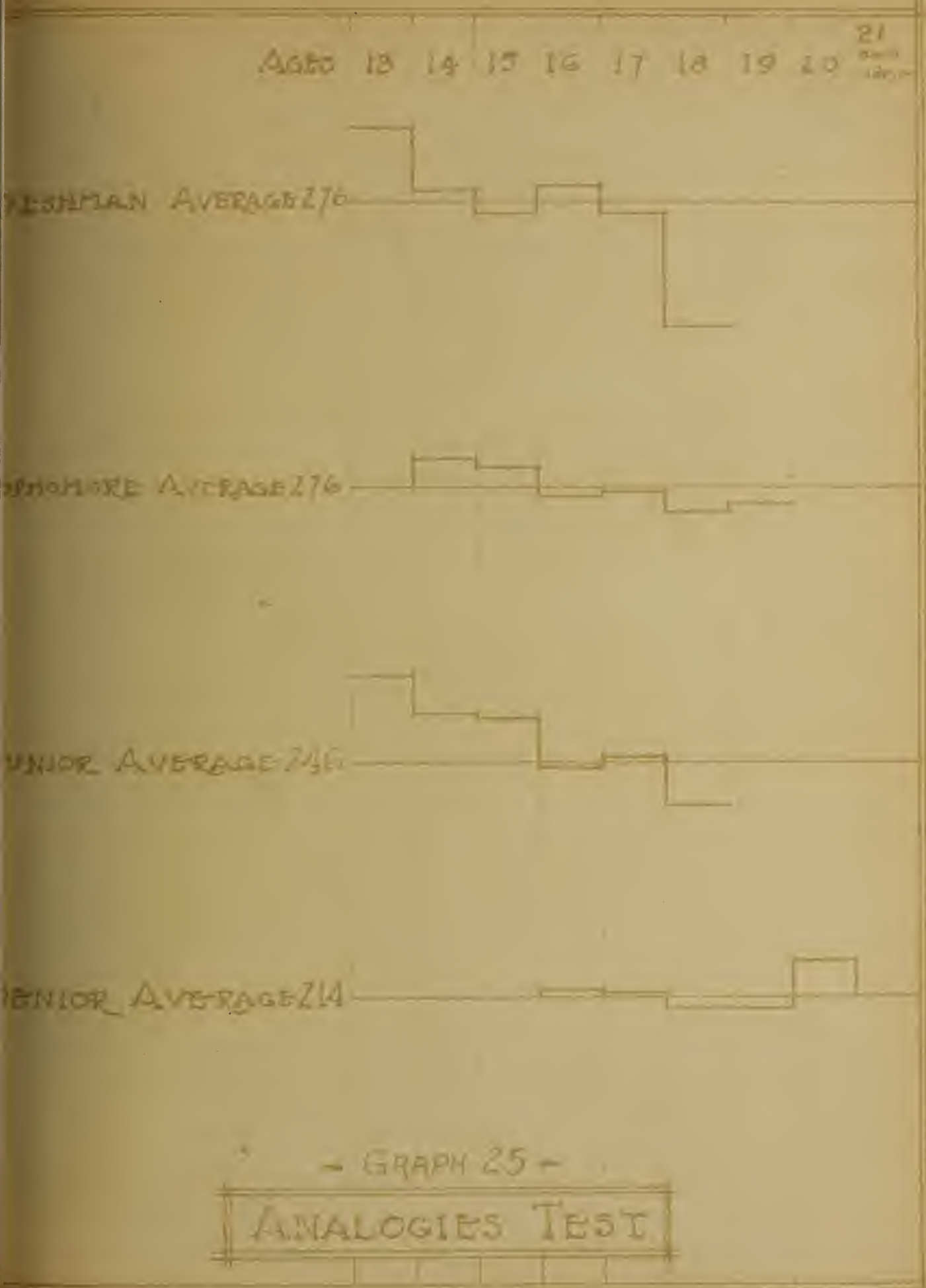
GRAPH 28

DUTCH HOMESTEAD



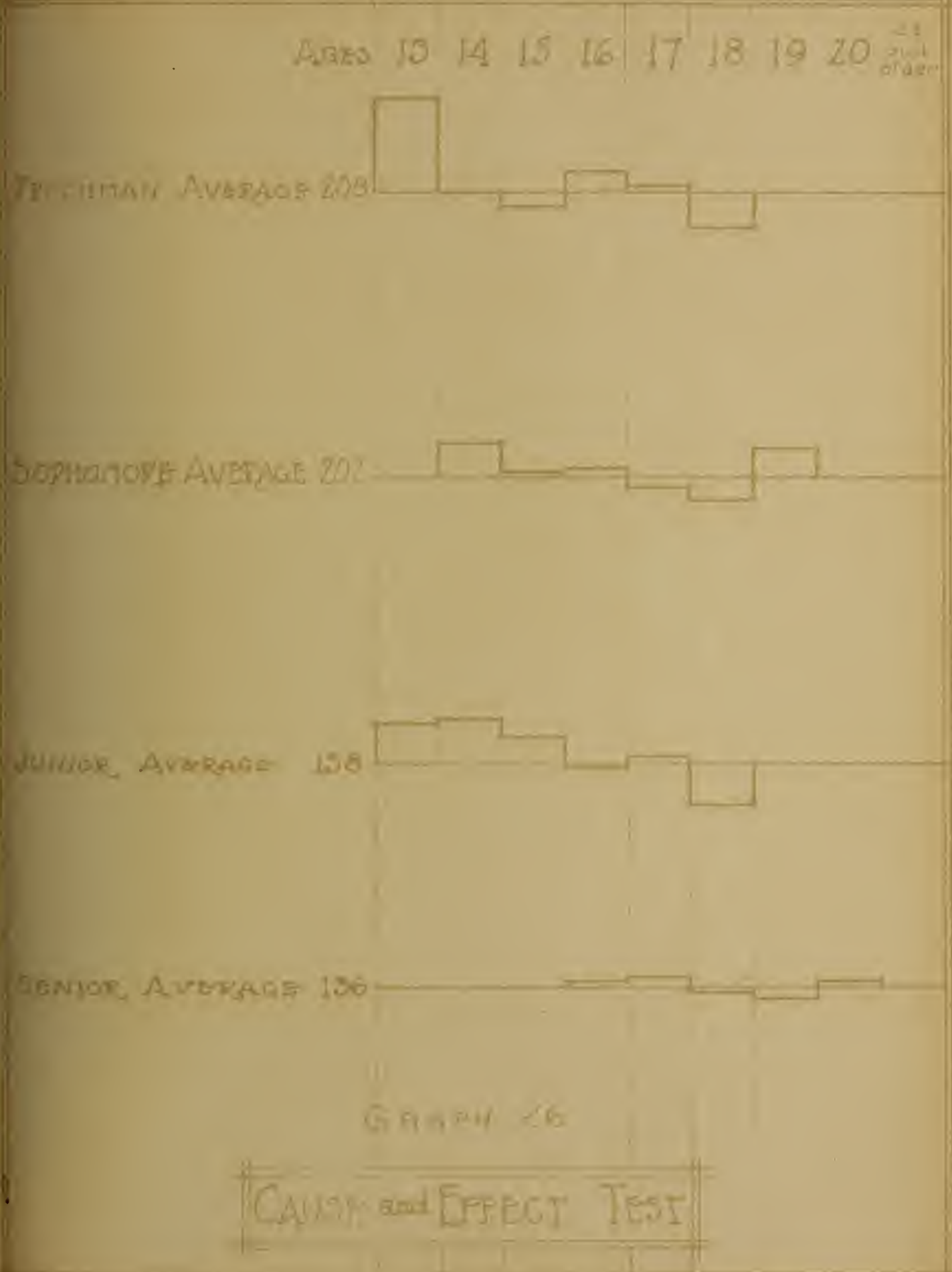
GRAPH 24

MARBLE STATUE



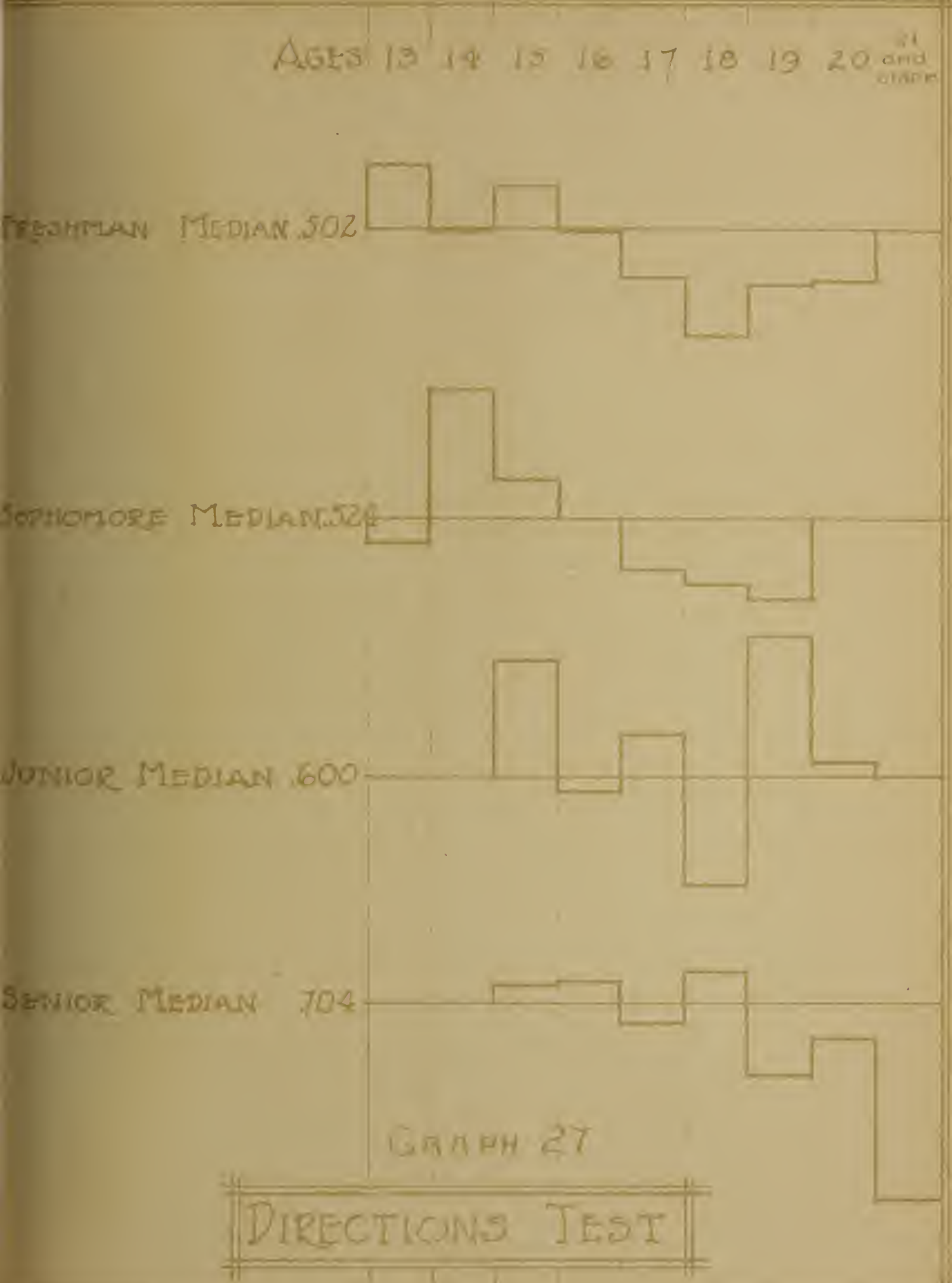
- GRAPH 25 -

ANALOGIES TEST



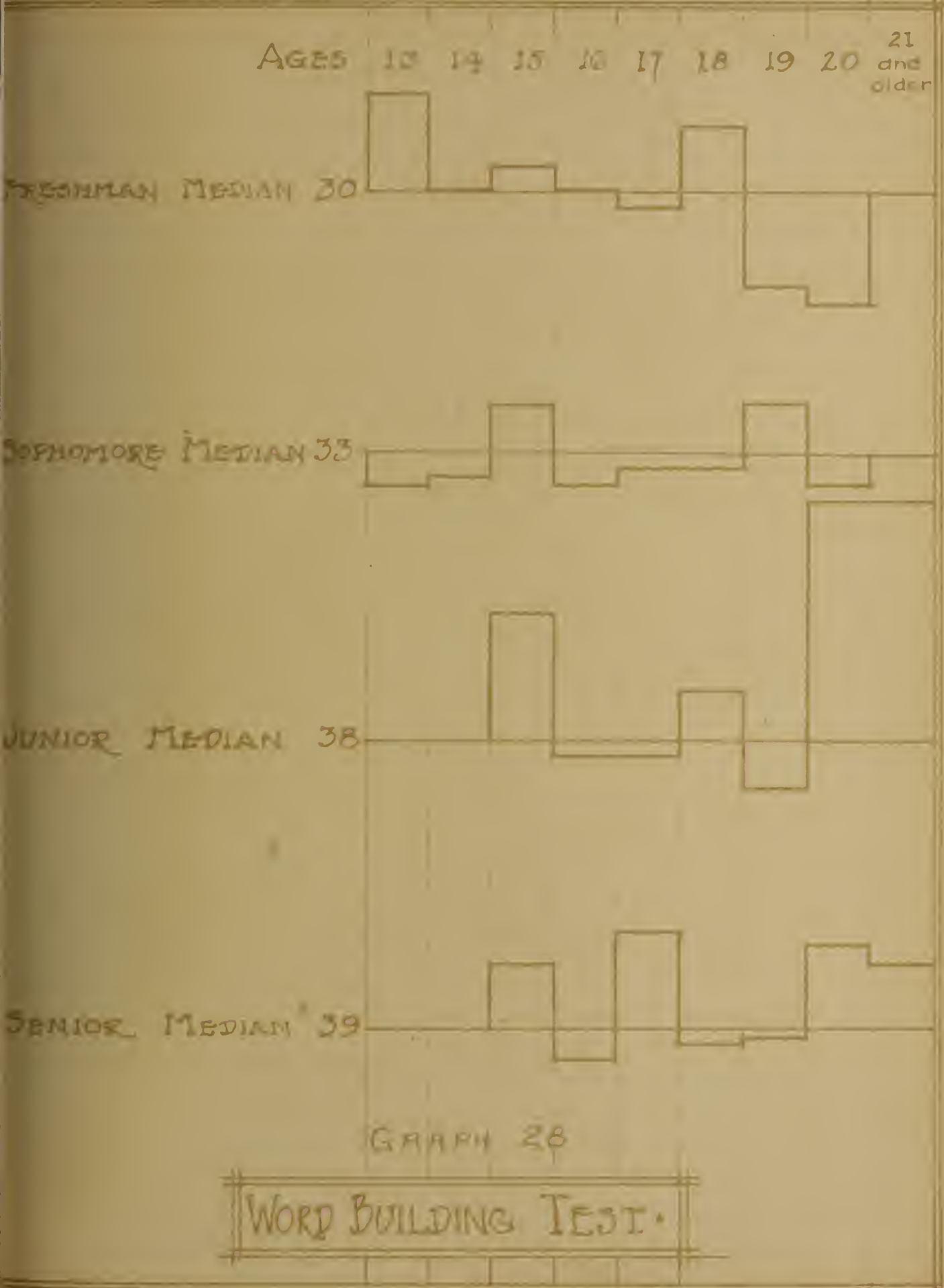
Graph #6

Cause and Effect Test



Graph 27

Directions Test

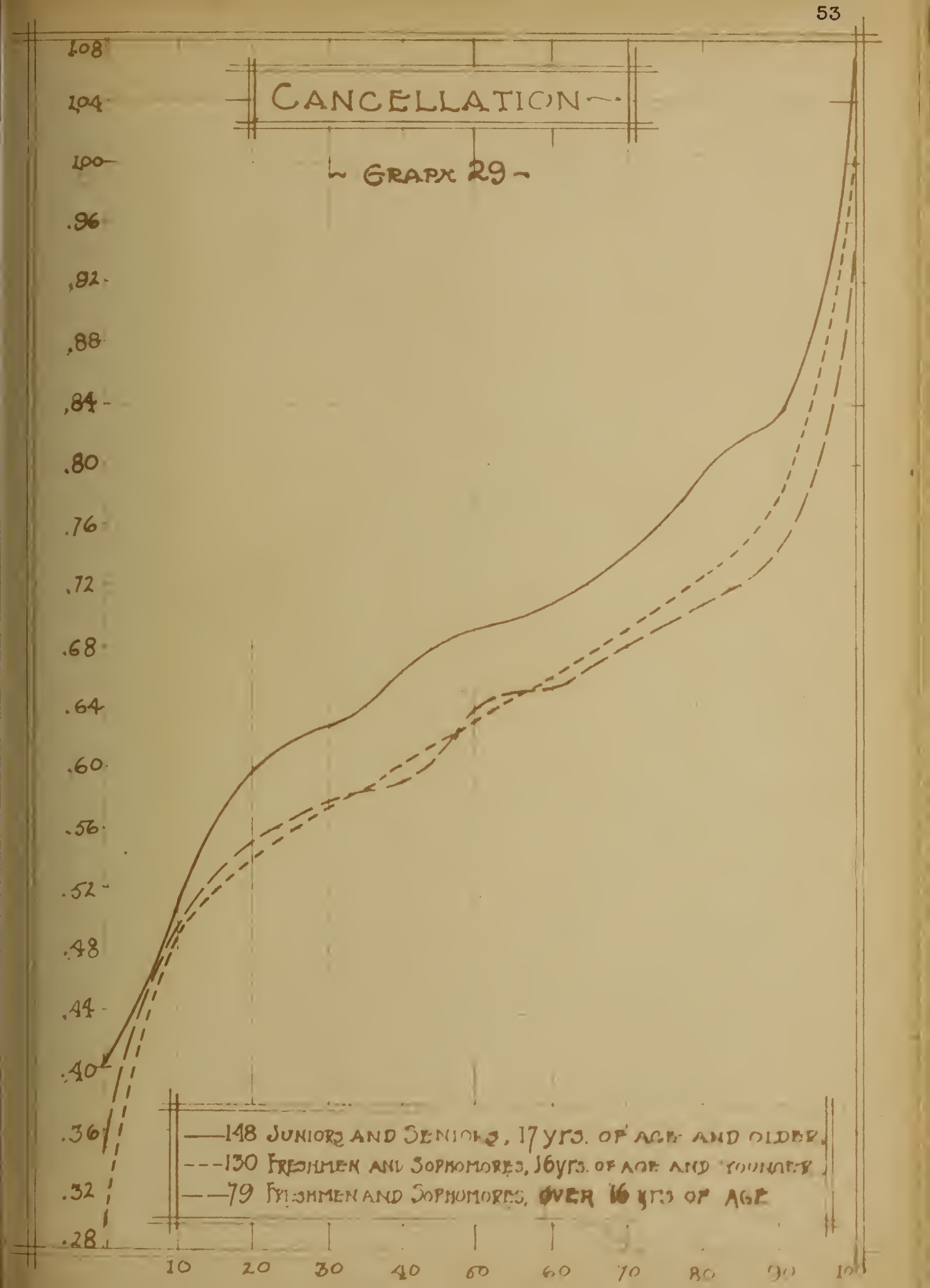


Graph 28

Word Building Test.

CANCELLATION

GRAPH 29



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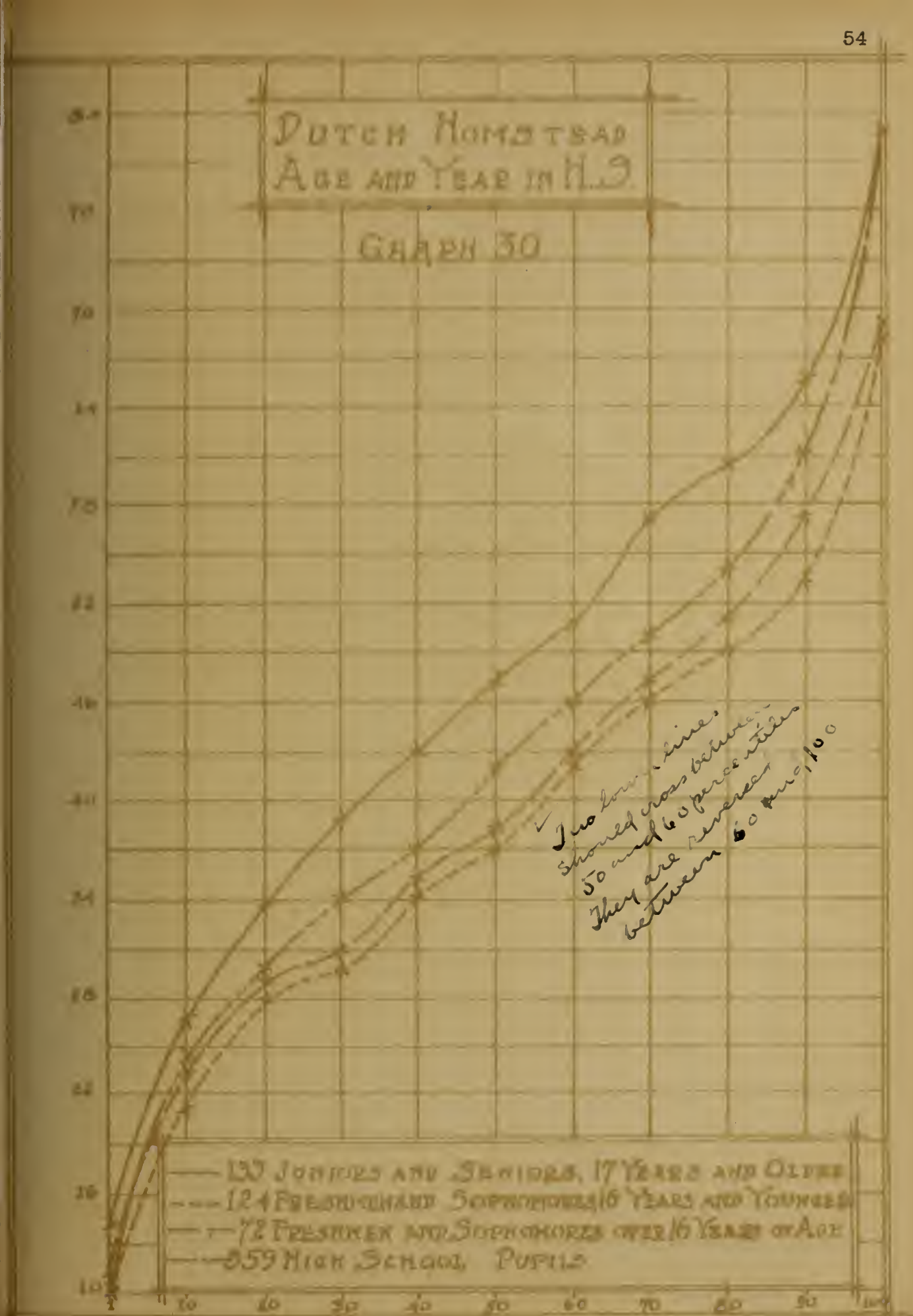
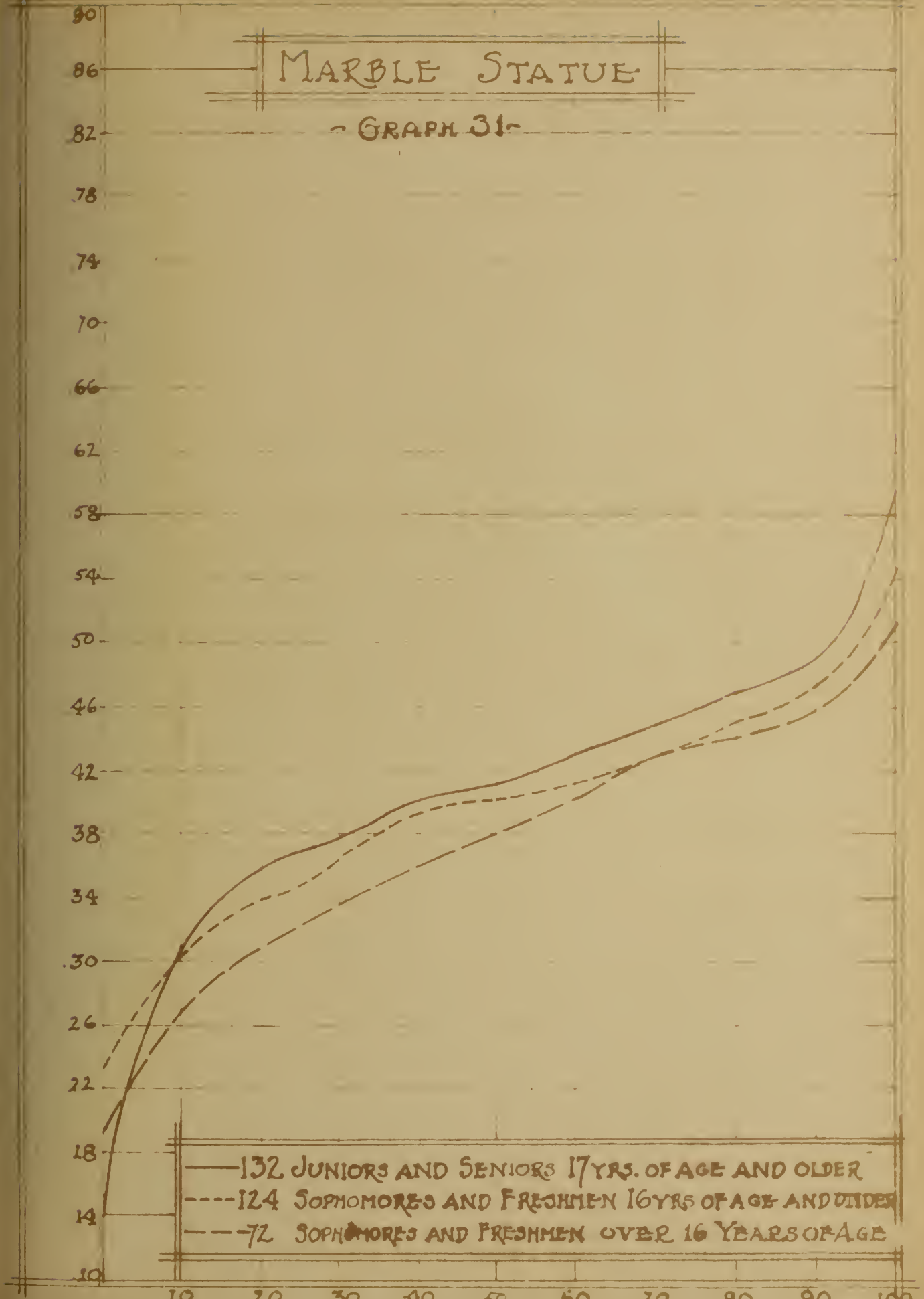
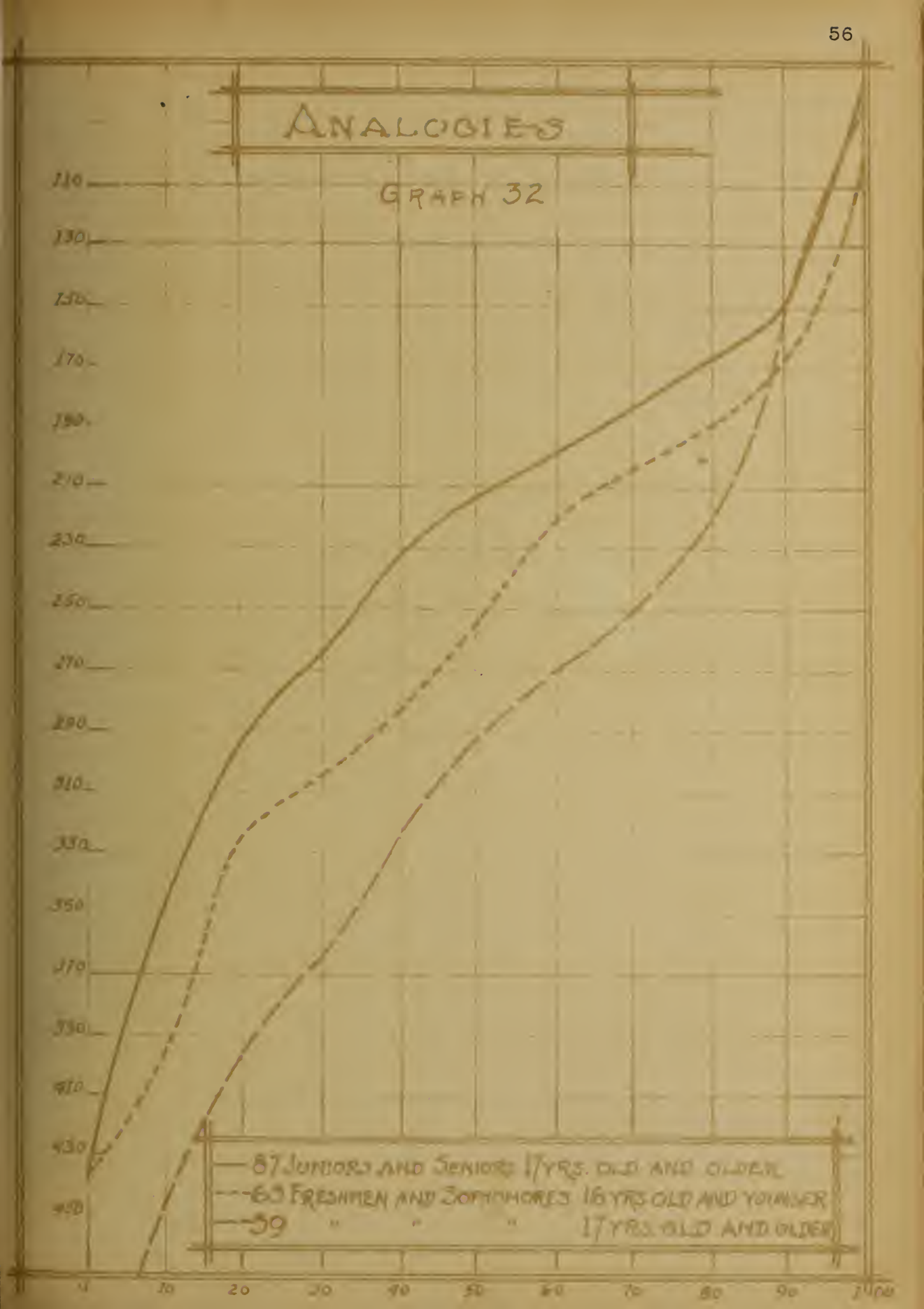

Dutch Homestead
Age and Year in H.S.
Graph 30
The low line showed cross between 50 and 60 per cent. They are between 60 and 100
130 Juniors and Seniors, 17 Years and Older
124 Freshmen and Sophomores 16 Years and Younger
72 Freshmen and Sophomores over 16 Years of Age
359 High School Pupils

MARBLE STATUE

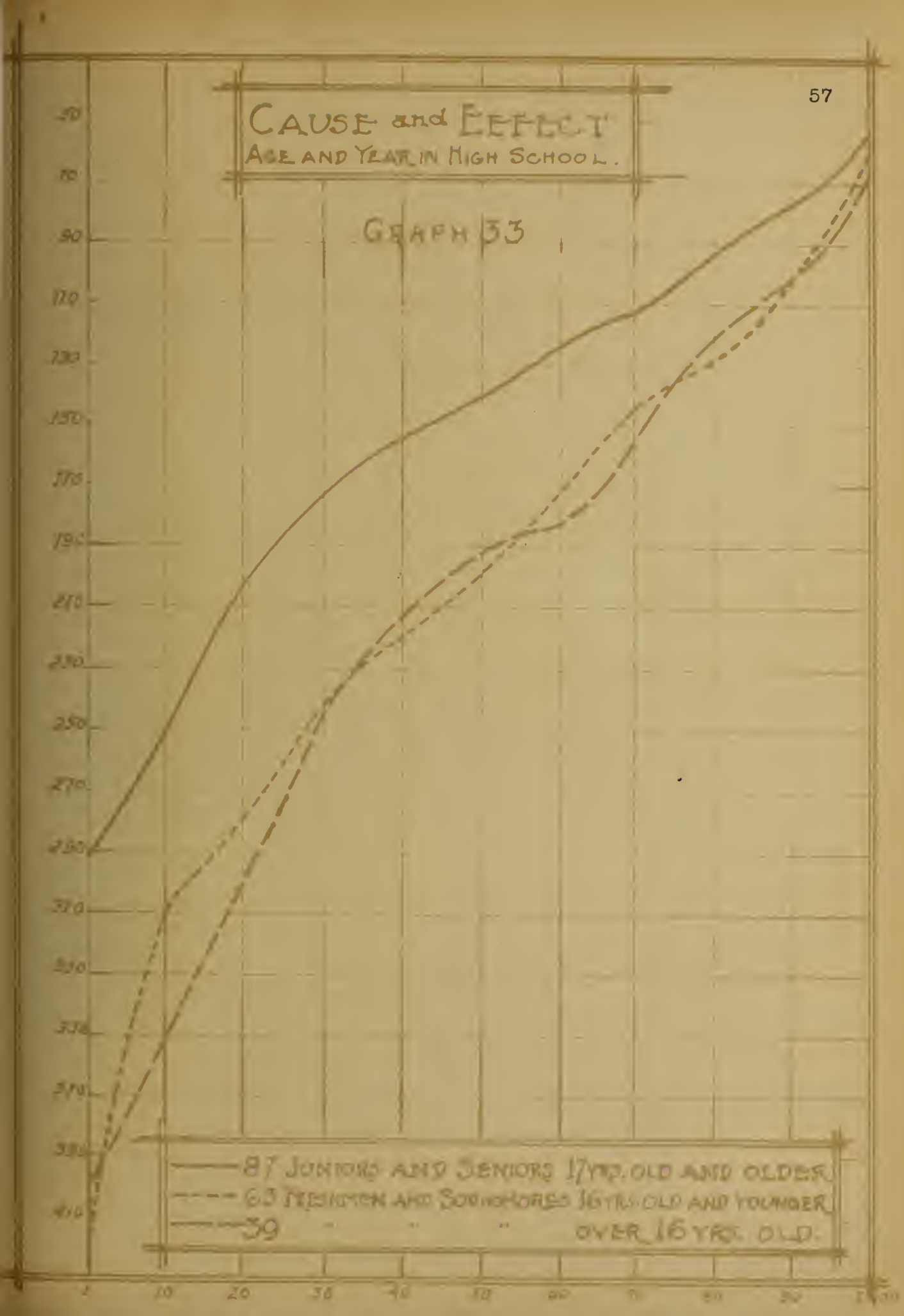
- GRAPH 31 -




ANALOGIES
GRAPH 32
110
130
150
170
190
210
230
250
270
290
310
330
350
370
390
410
430
450
87 JUNIORS AND SENIORS 17 YRS. OLD AND OLDER
63 FRESHMEN AND SOPHOMORES 16 YRS OLD AND YOUNGER
59 " " " 17 YRS. OLD AND OLDER
10
20
30
40
50
60
70
80
90
100

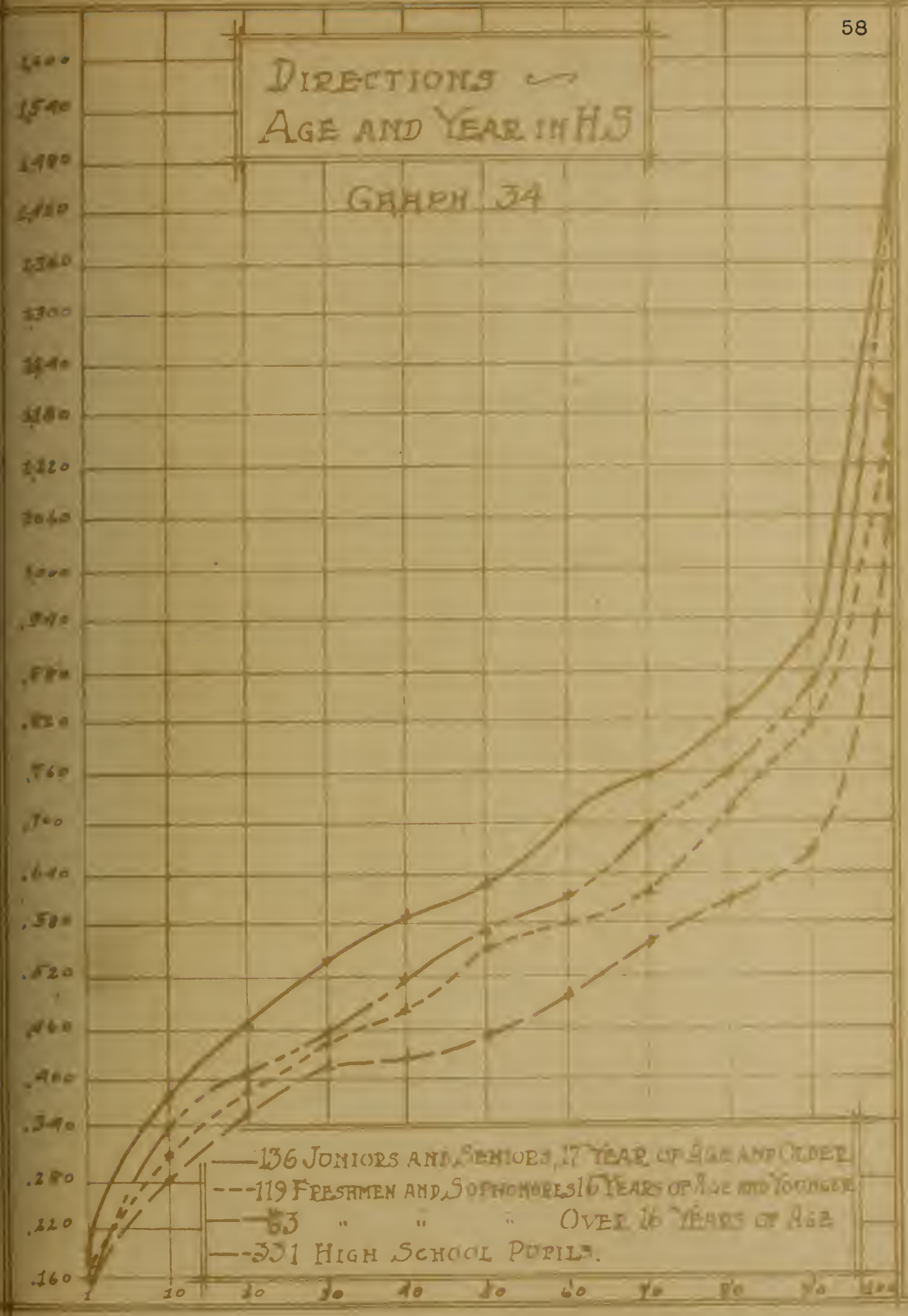
CAUSE and EFFECT
AGE AND YEAR IN HIGH SCHOOL.

GRAPH 33



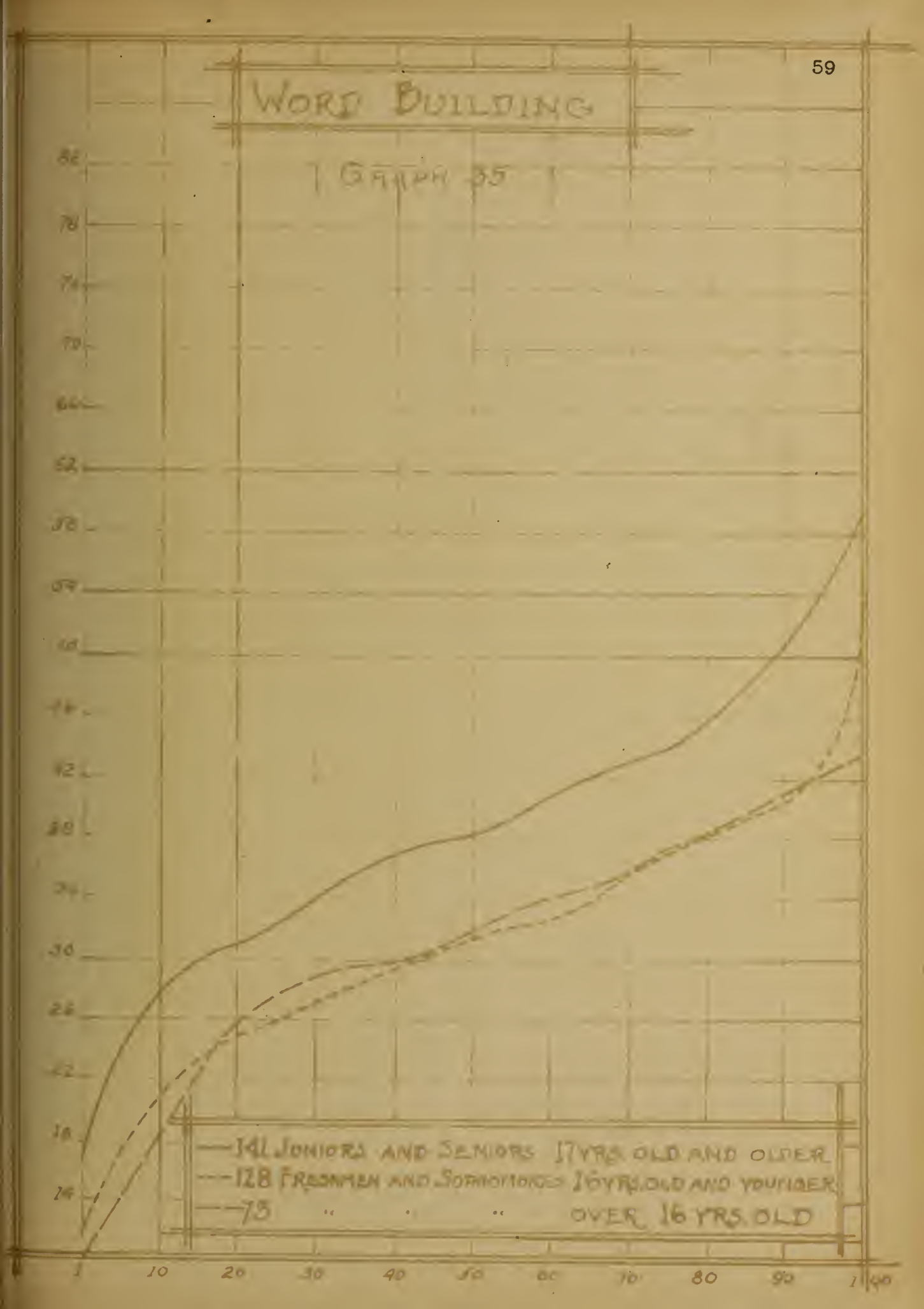
Directions ~
Age and Year in H.S.

Graph 34



WORD BUILDING

GRAPH 35



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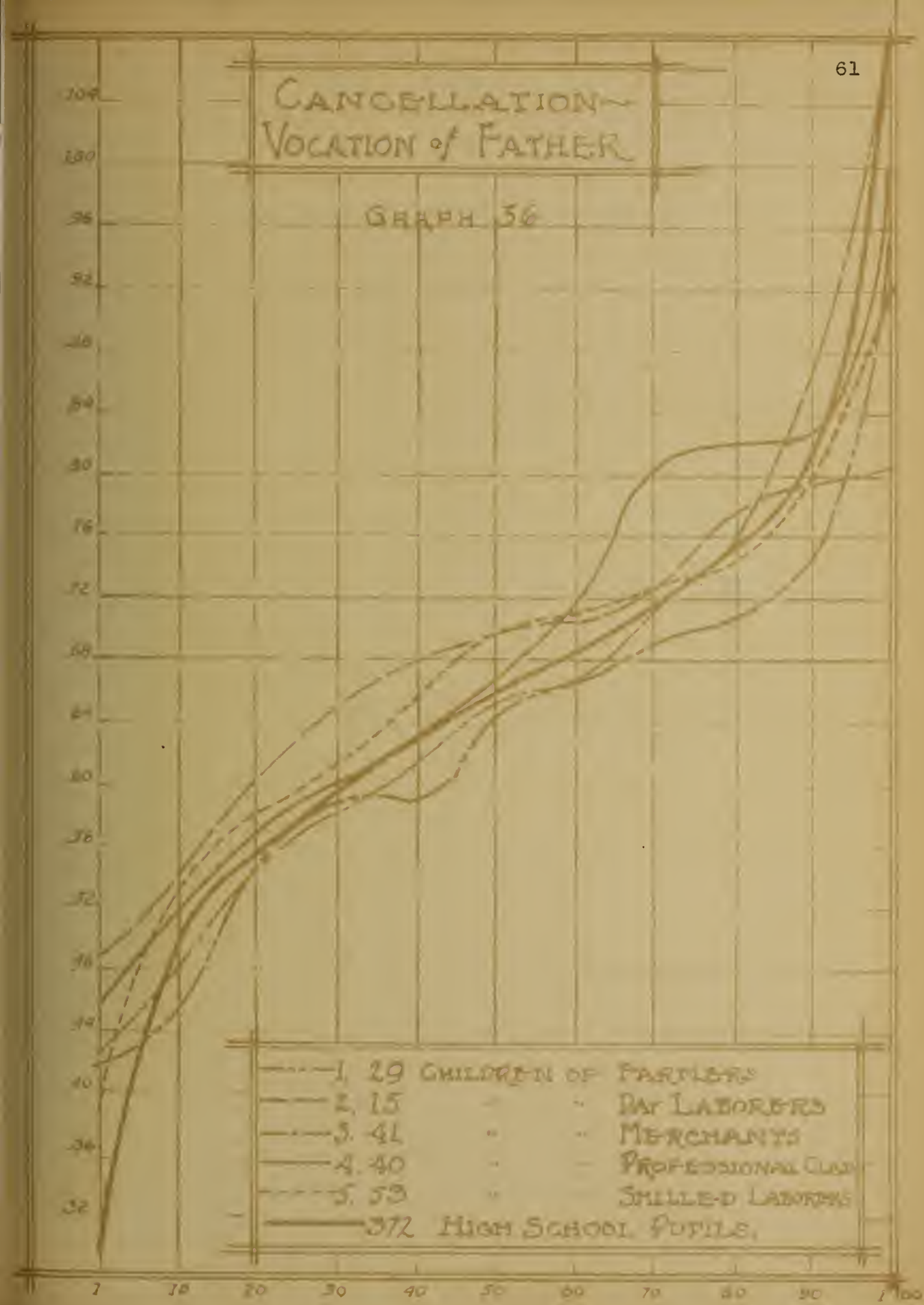
Vocation of Father

The pupils were divided into five classes, children of farmers, children of day laborers, children of merchants, children of the professional classes and children of skilled laborers. In the farmer class no distinction was made between farmers who owned their farms and laborers on the farm. In the merchant class are men in business, not merely retail merchants. In the professional class are included clergymen, teachers, lawyers, physicians, and university professors. In the skilled labor class are included those workers in trades where a certain amount of skill is necessary for the proper performance of their work. This class includes, carpenters, brick masons, barbers, etc.

Percentile graphs 36 and 42 show the difference in the performance of these different groups in the seven tests. Assuming that men who are in the professions are for most part there because of a higher degree of general intelligence than the day laborer, one would expect the children of the group demanding a higher degree of general intelligence to rank higher than the day laborers in those tests which correlate positively with general intelligence. "Like tends to beget like." It will be observed from Graphs 37, 38, 39, 40, 41 and 42 that the children of the professional class hold a relatively high position. The superiority of the professional class would probably be greater were it not for the fact that economic conditions tended to furnish a select group of children from the laboring class, and that in the case of the professional class family tradition tended to hold in school a larger proportion of children of

CANCELLATION— VOCATION of FATHER

GRAPH 36



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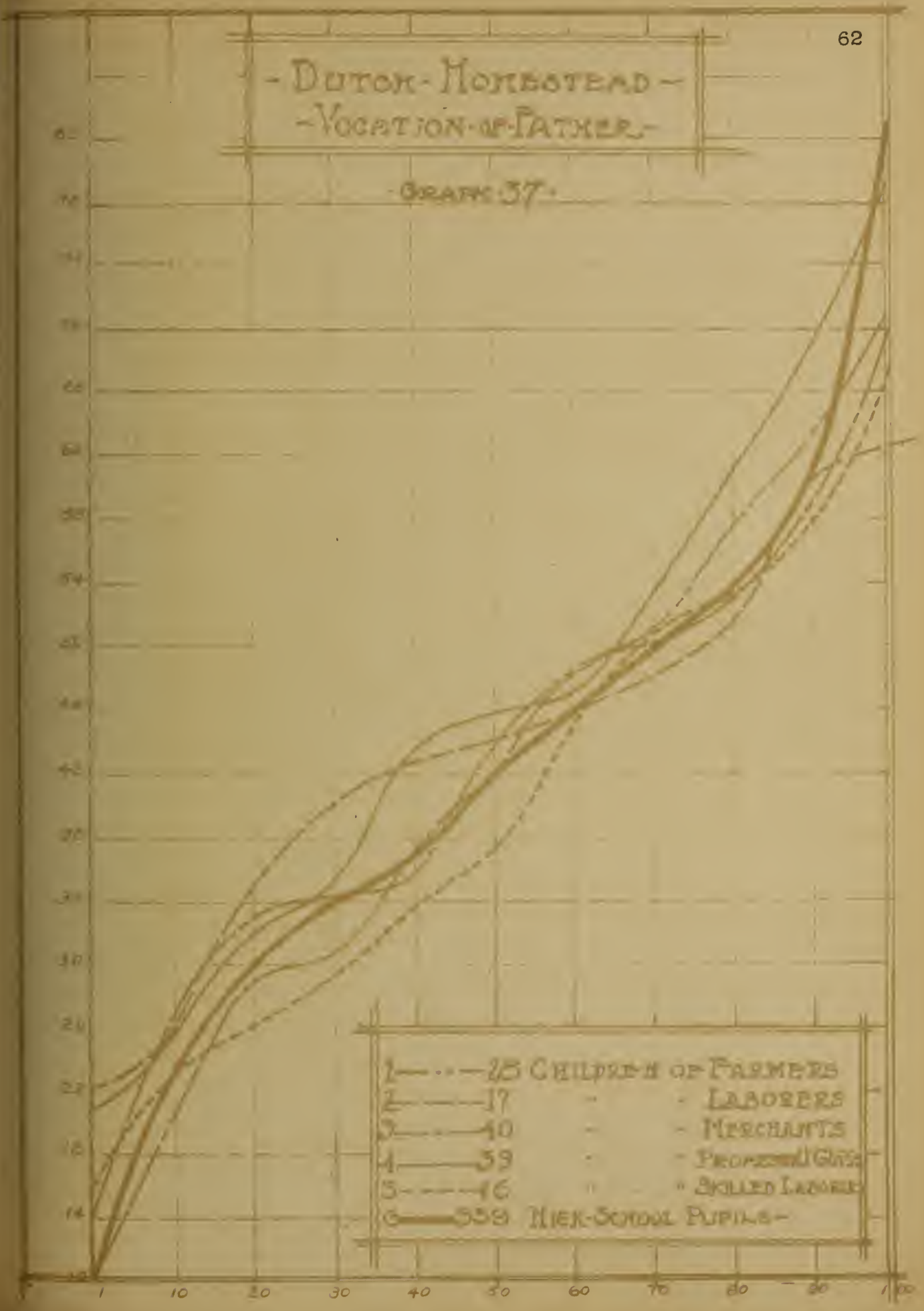
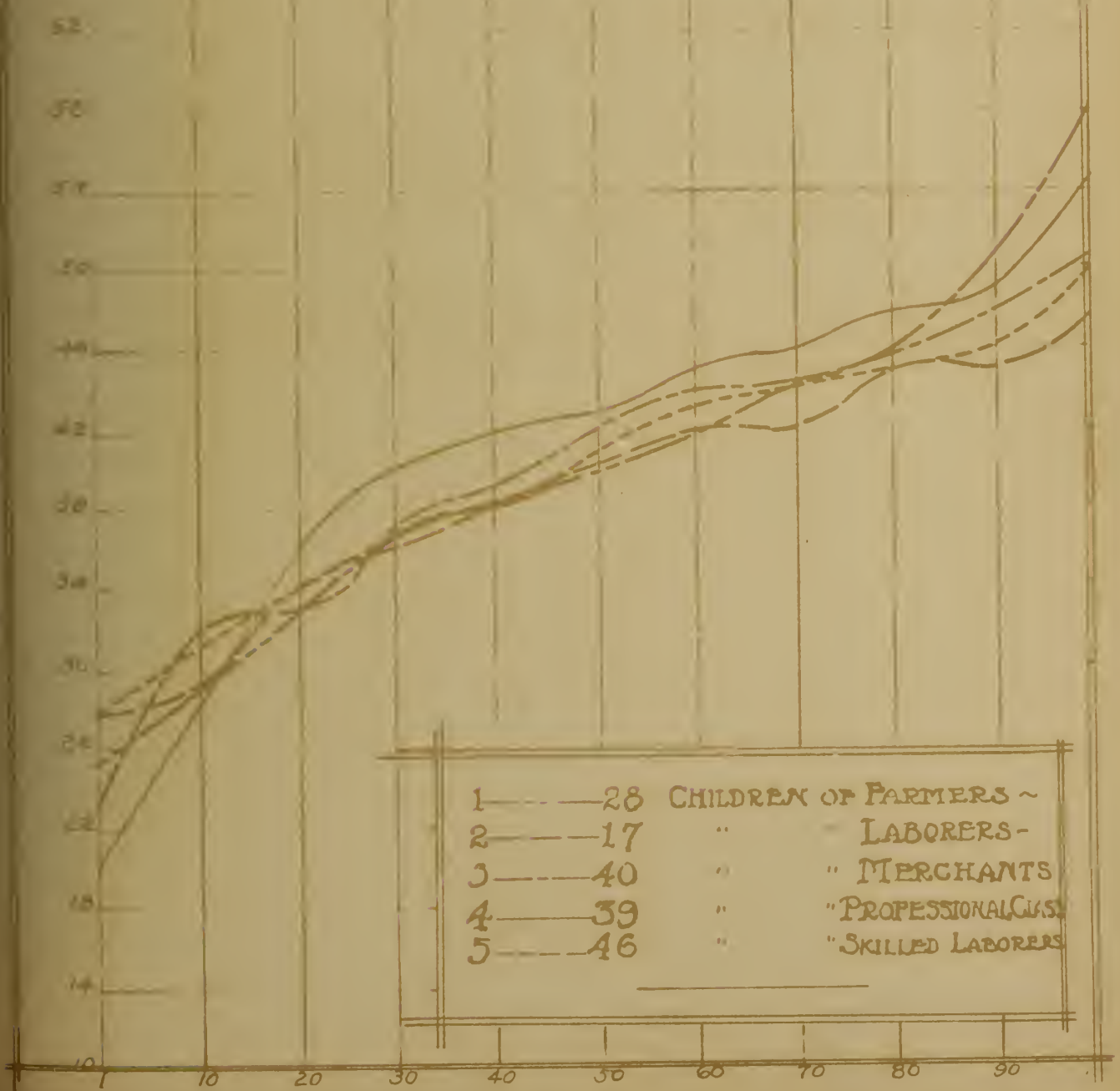
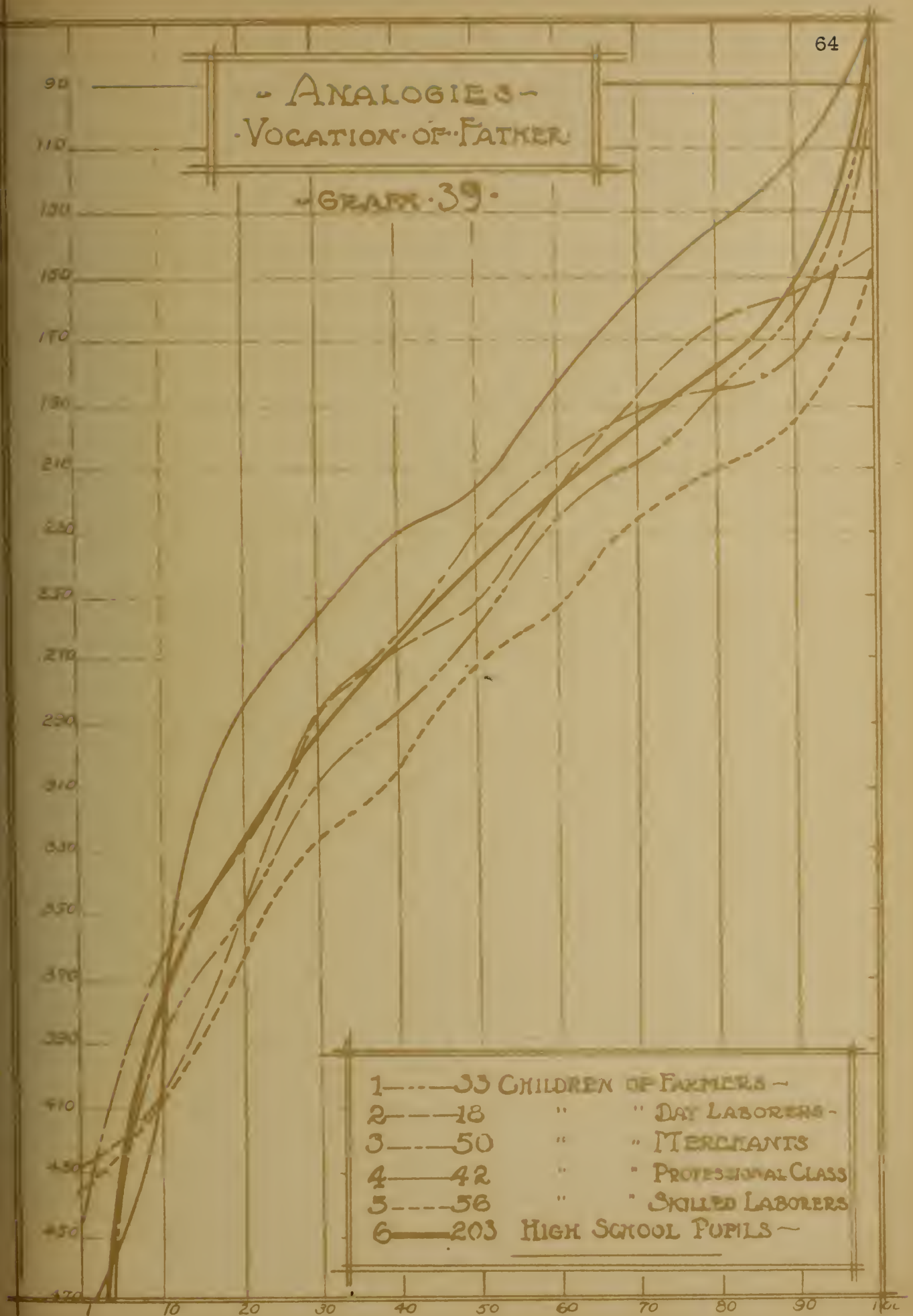

- Dutch - Homestead -
- Vocation of Father -
Graph 37.
1 —·—·— 25 Children of Farmers
2 ——— 17 " " Laborers
3 — — — 10 " " Merchants
4 ——— 39 " " Professional Class
5 — — — 16 " " Skilled Laborers
6 ——— 339 High-School Pupils -
1
10
20
30
40
50
60
70
80
90
100

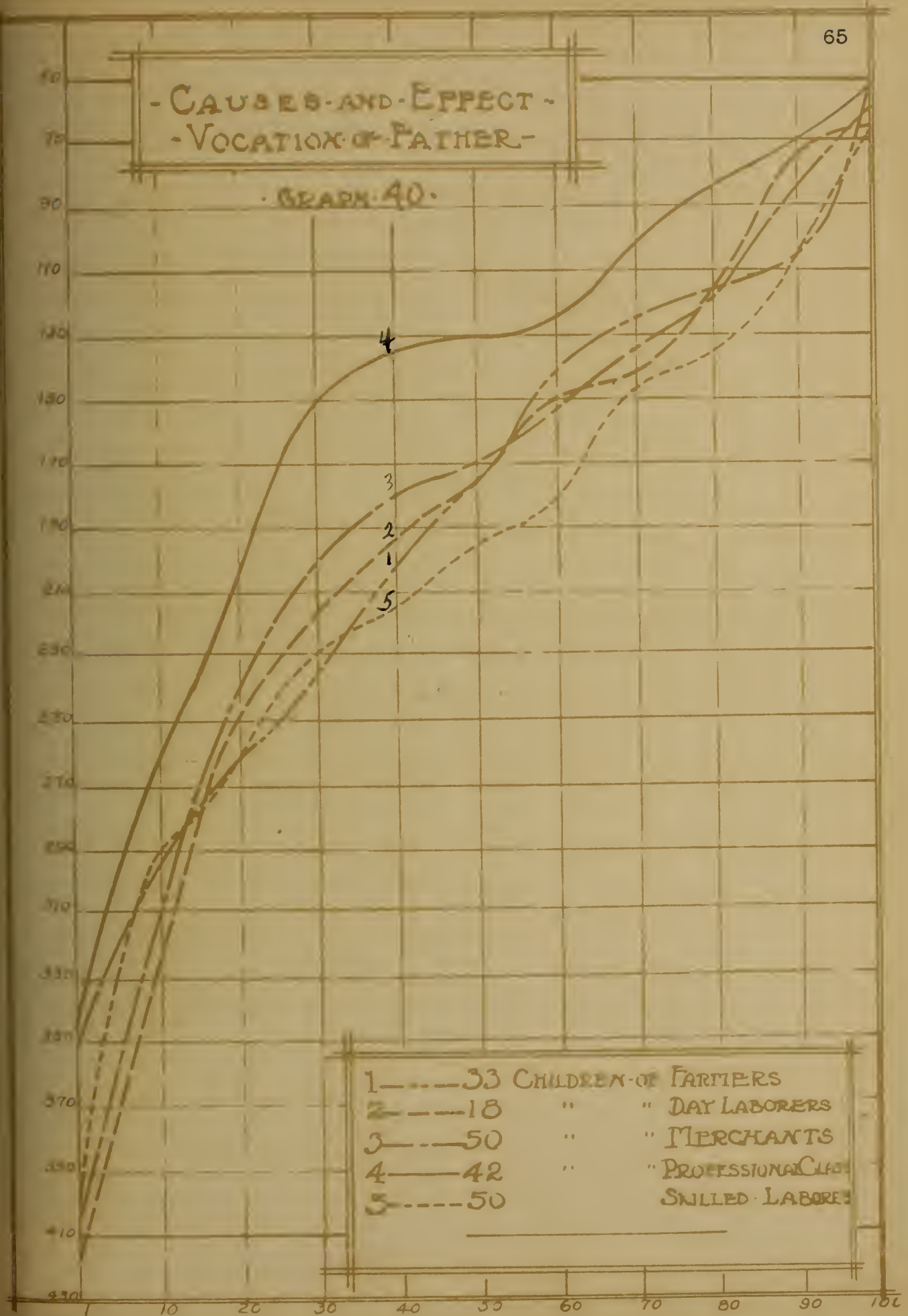
- MARBLE · STATUE -
- VOCATION OF FATHER -

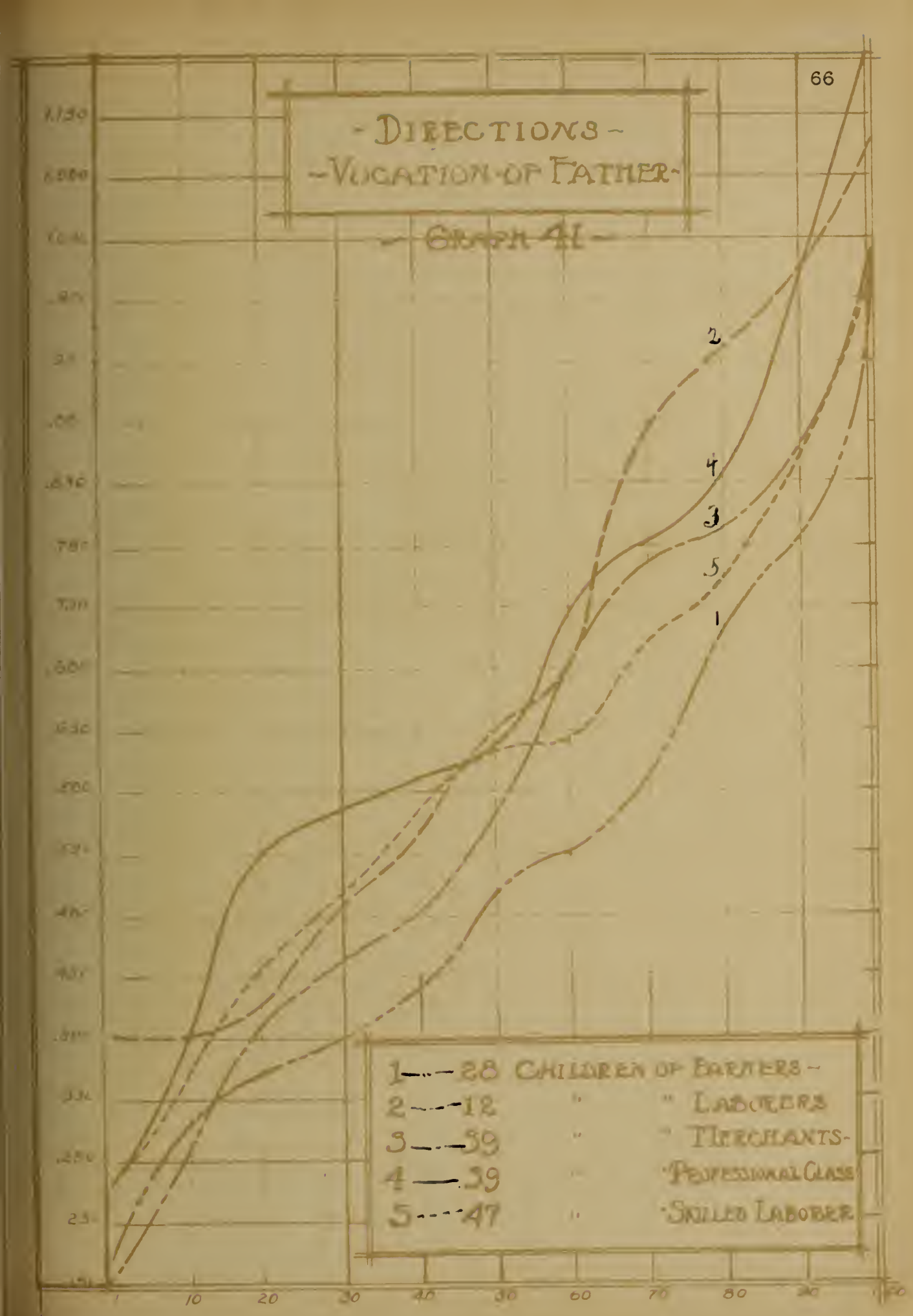
- GRAPH 38 -



- ANALOGIES -
- VOCATION OF FATHER -
- GRAPH 39 -

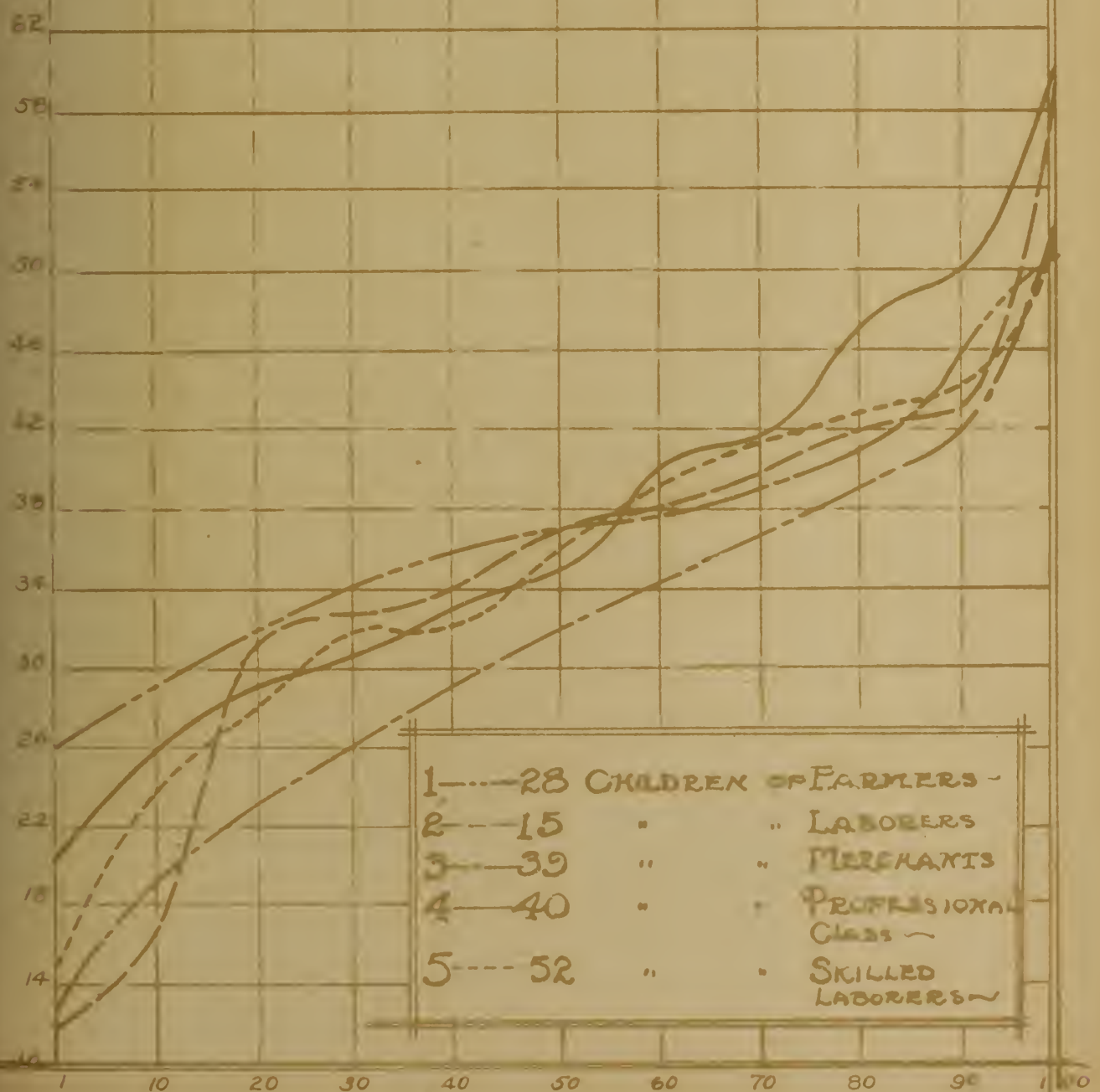



-CAUSES-AND-EFFECT-
-VOCATION-OF-FATHER-
-GRADE-9A-
4
3
2
1
5
1----33 CHILDREN-OF FARMERS
2----18 " " DAY LABORERS
3----50 " " MERCHANTS
4----42 " " PROFESSIONAL CLASS
5----50 SKILLED LABORERS
1
10
20
30
40
50
60
70
80
90
100


- DIRECTIONS -
-VOCATION OF FATHER-
- GRAPH 41 -
2
4
3
5
1
1—28 CHILDREN OF FARMERS -
2—12 " " LABORERS
3—39 " " MERCHANTS -
4—39 " PROFESSIONAL CLASS
5—47 " SKILLED LABORER
10
20
30
40
50
60
70
80

WORD BUILDING ~ VOCATION OF FATHER ~

~ GRAPH 42 ~



poorer ability.

In the laboring class with larger families there would be a tendency to keep in school the children in the family who were capable and to permit those who found school irksome because of lack of ability, to drop out of school and go to work to contribute to the support of the family.

In the professional class family tradition for high-school education would tend to keep all children of this class in high school,* and would thus operate to lower the average performance in the tests, for children in this class.

In spite of these influences the superiority of the professional class is marked. The author believes that the general intelligence of all of the children of the professional class compared to the general intelligence of all the children of the laboring class is even more superior than the results of the tests would indicate. In the analogies test and the cause and effect test the superiority could not be attributed to better environmental influences since the test is designed to eliminate such influences. Any pupil 14 years of age would have sufficient information to pass the test. If he did not have the information demanded in the test, it would be safe to conclude ipso facto that his general intelligence was below the normal.

There might be some reason to believe that the experiences of a child in the professional class would account in part for his

*For evidence of such a tradition consult C.E. Holley, The Relationship between Persistence in School and Home Conditions. Fifteenth Yearbook, Part II, of the National Society for the Study of Education, 1916.

superiority in the cause and effect test. Although a special effort was made to select nouns the meaning of which would be clear to all children of high-school age, it was discovered in applying the test that informational difficulties were present in some cases. In giving the effects of the twenty nouns considered as causes, it was evident that students with a good vocabulary experienced less difficulty. This probably accounts for the fact that the cause and effect test correlates highly with performance in high-school English.

In the cancellation test, Graph 36, which has a slight negative correlation with general intelligence, the children of the professional class do not rank so high.

The author was surprised at first at the relatively low standing of the children of the skilled-labor class in the tests that correlate highly with general intelligence. Skilled labor, however, does not demand a high degree of general intelligence. Much of skilled labor is performed by 'rule of thumb.' One would expect this class to excel in tests where coördination of hand and eye was demanded, where speed in accomplishing tasks relatively simple and mechanical was required. The one test of the seven tests used that would come nearest measuring this ability is the cancellation test, Graph 36. In this test the children of the day laborers and the skilled laborers excel. Sixty per cent of the children of skilled laborers are above the median score of the professional class.

While more cases would probably be necessary to establish the fact, the author believes he is warranted in concluding that the children of the professional class do excel in the tests that correlate highest with general intelligence and that the superiority

is due to hereditary rather than to environmental influences. The inferiority of the skilled-labor class in the same tests and their superiority in the cancellation test is probably due to hereditary rather than environmental influences.

Years of Schooling of Father

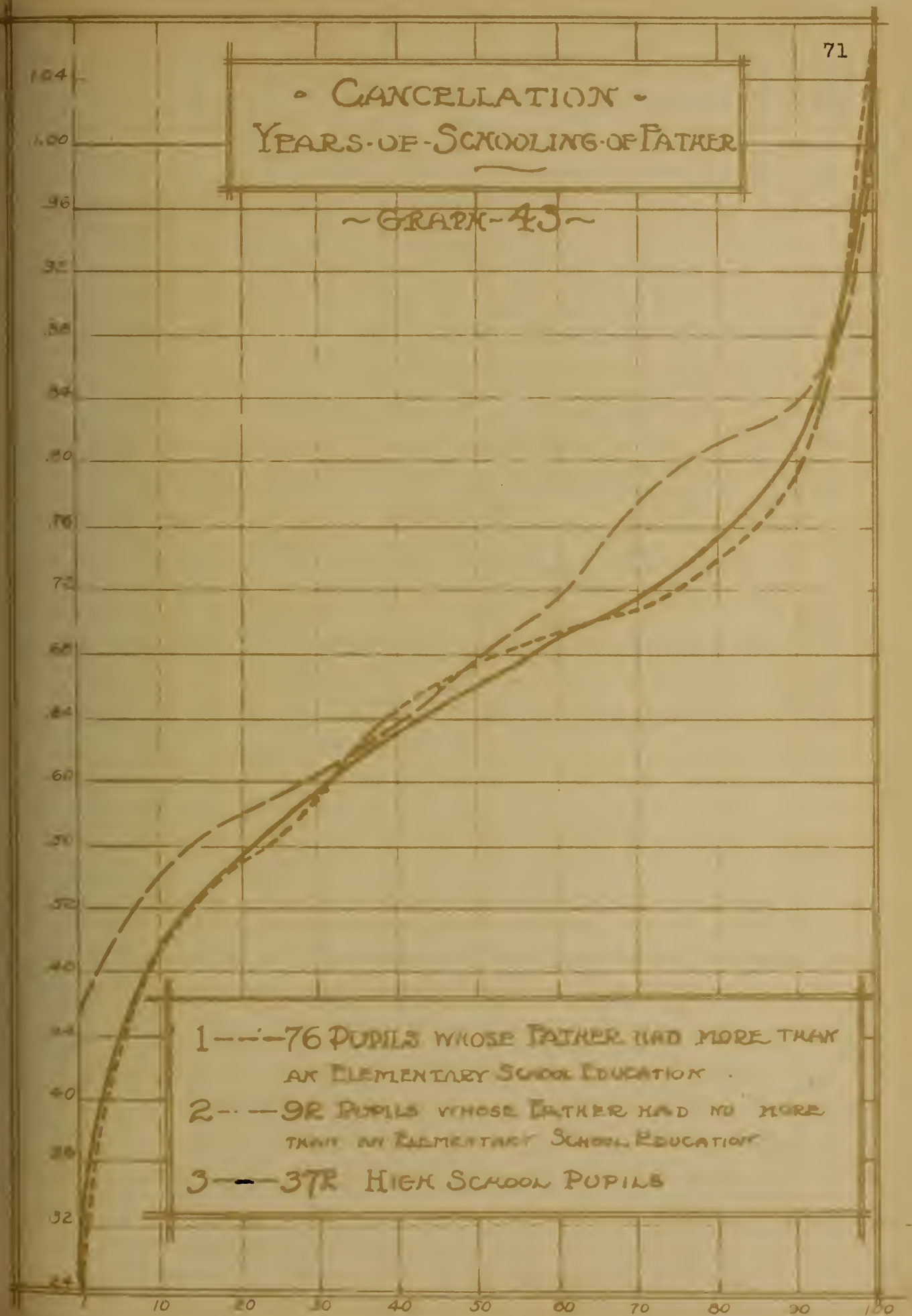
In connection with the years of schooling of father, are considered only two of the tests, the cancellation test, which correlates least with general intelligence, and the analogies test, which shows the highest correlation with general intelligence.

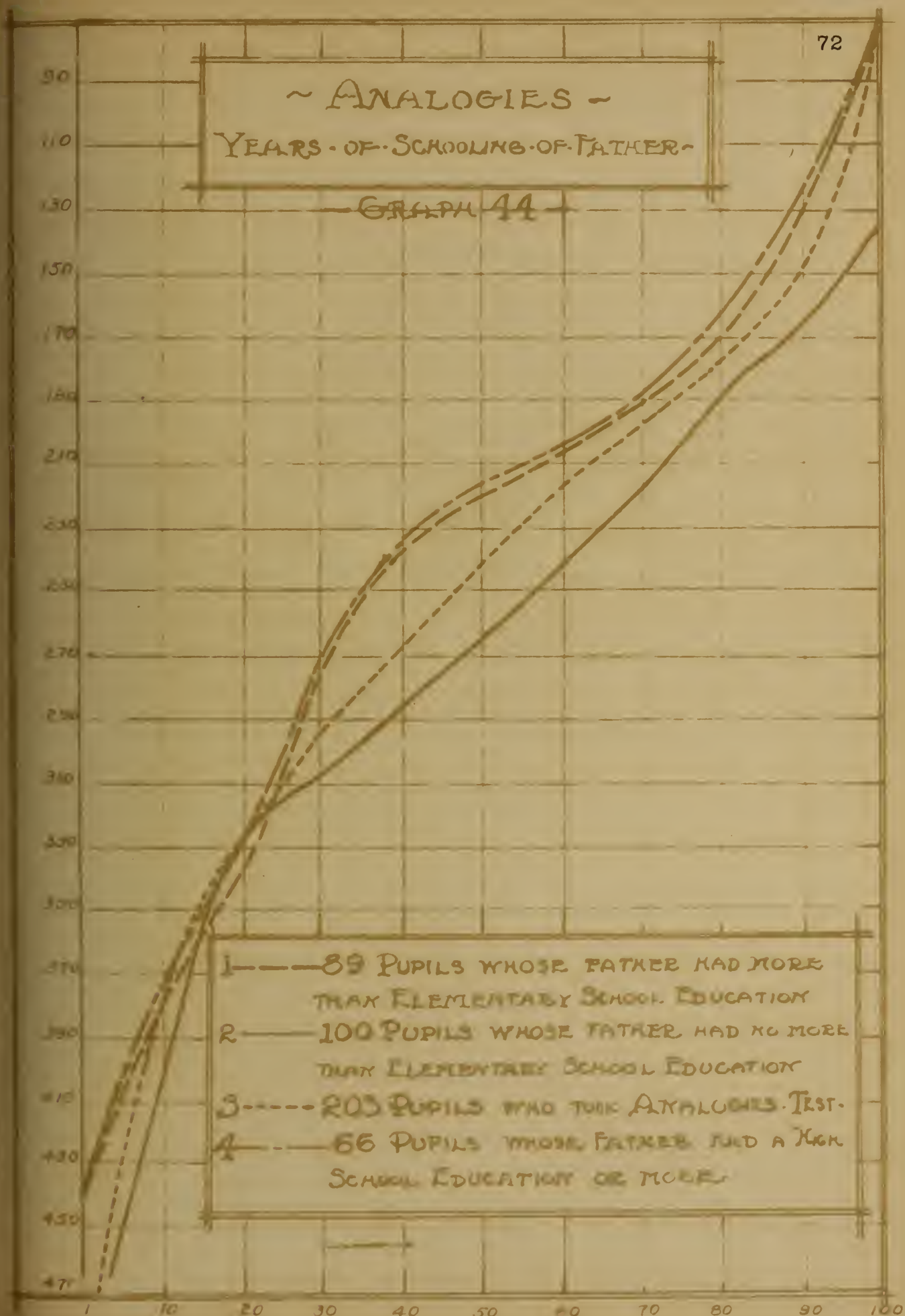
In the cancellation test, Graph 43, the superiority of the 76 students whose fathers had more than an elementary education, over the 92 students whose fathers had only elementary education or less is not marked, whereas in the analogies test, Graph 44, it is to be observed that 70 pér cent of the former group is above the median score of the latter group.

The students whose fathers had four years or more beyond the elementary school do slightly better in the analogies test than do those whose fathers had less than this number of years of schooling. Economic conditions and family tradition, the same selective agencies discussed in the previous section, would tend to lessen the difference between the groups under discussion, so that the true difference in ability is probably greater than that indicated by the graph.

This difference in ability may reasonably be attributed to heredity, since no one could contend that years of schooling of the father in itself could influence the performance of his child in the analogies test.

CANCELLATION
YEARS-OF-SCHOOLING-OF-FATHER
~GRAPH-43~




~ ANALOGIES ~
YEARS · OF · SCHOOLING · OF · FATHER ~
GRAPH 44
90
110
130
150
170
190
210
230
250
270
290
310
330
350
370
390
410
430
450
470
1 10 20 30 40 50 60 70 80 90 100
1———89 PUPILS WHOSE FATHER HAD MORE THAN ELEMENTARY SCHOOL EDUCATION
2———100 PUPILS WHOSE FATHER HAD NO MORE THAN ELEMENTARY SCHOOL EDUCATION
3- - - - -203 PUPILS WHO TOOK ANALOGIES TEST.
4— - —66 PUPILS WHOSE FATHERS HAD A HIGH SCHOOL EDUCATION OR MORE

Size of Family

In Graph 45, which shows the relation between performance in the analogies test and size of family, is to be found a confirmation of the earlier statement that size of family was a selective agency. The 69 students from families of over four children do slightly better in the analogies test than do the 74 students from families of three and four children. The superiority of the 52 students from families of 1 and 2 children is to be explained by the fact that in this group are to be found a large number of children from the professional class.

The differences of performance among these groups are so small that the explanations offered should be considered suggestive rather than conclusive.

Curiosity prompted the author to construct Graph 46, which is presented with no interpretations or conclusions. No explanation is offered for the relatively low performance of the third-born children.

Preference for Mathematics and Languages

There is a high correlation between the analogies test and school marks in mathematics. Graph 47 shows that students who give mathematics as their first or second preference, do much better in the analogies test than those who say mathematics is their most difficult subject or who have failed in it. This seems to indicate that the possession of that ability in the test which correlates with performance in mathematics is a factor in determining the preference for that subject and that lack of that ability is a factor in determining the dislike for, and failure in, that subject.

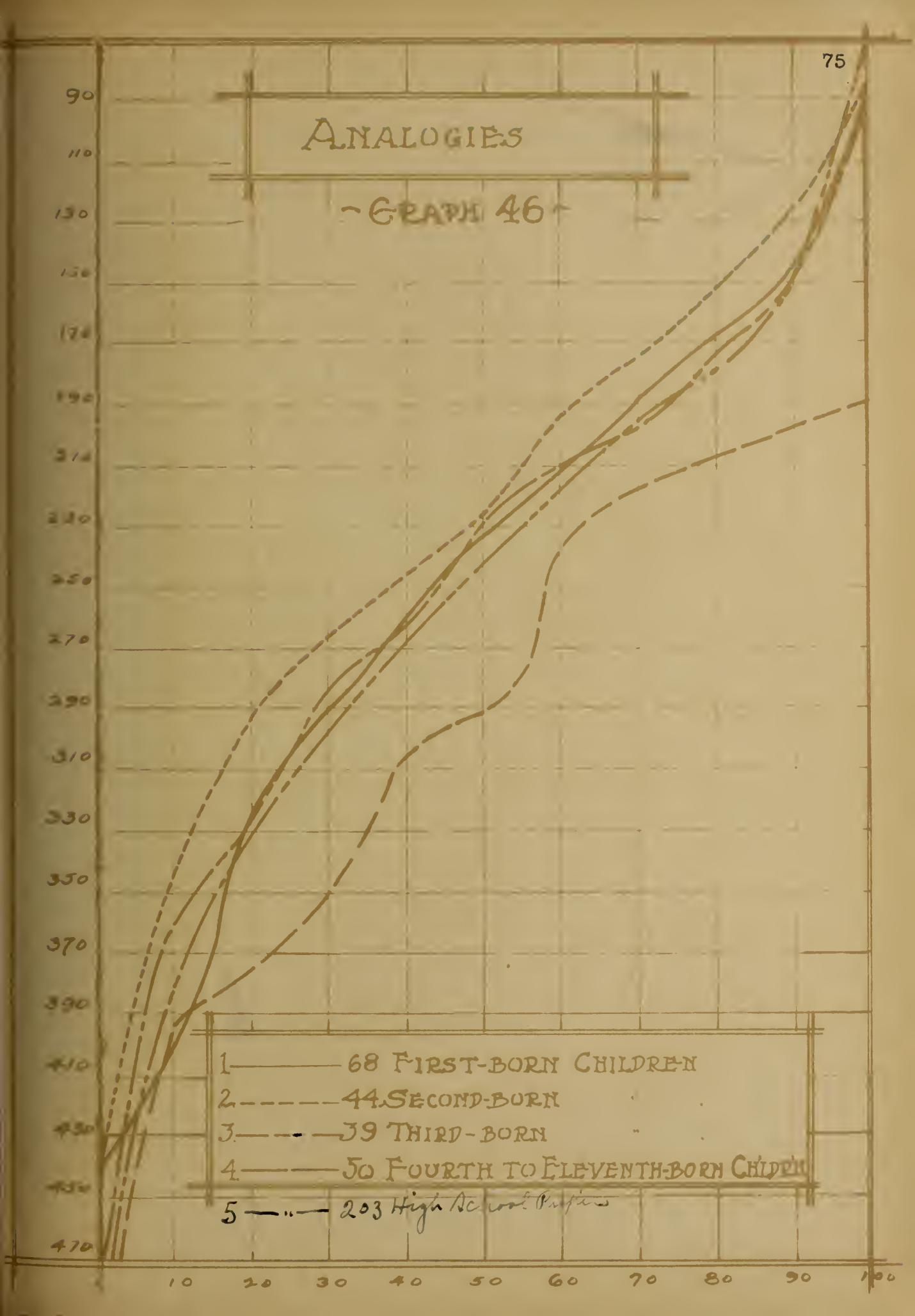
The analogies test shows a high correlation with general

ANALOGIES
SIZE OF FAMILY
- GRADE 45 -

1 74 PUPILS FROM FAMILIES OF 3 AND 4 CHILDREN
2 69 " " " OVER 4 "
3 52 " " " 1 AND 2 "
4 203 HIGH SCHOOL PUPILS.

ANALOGIES

~GRAPH 46~



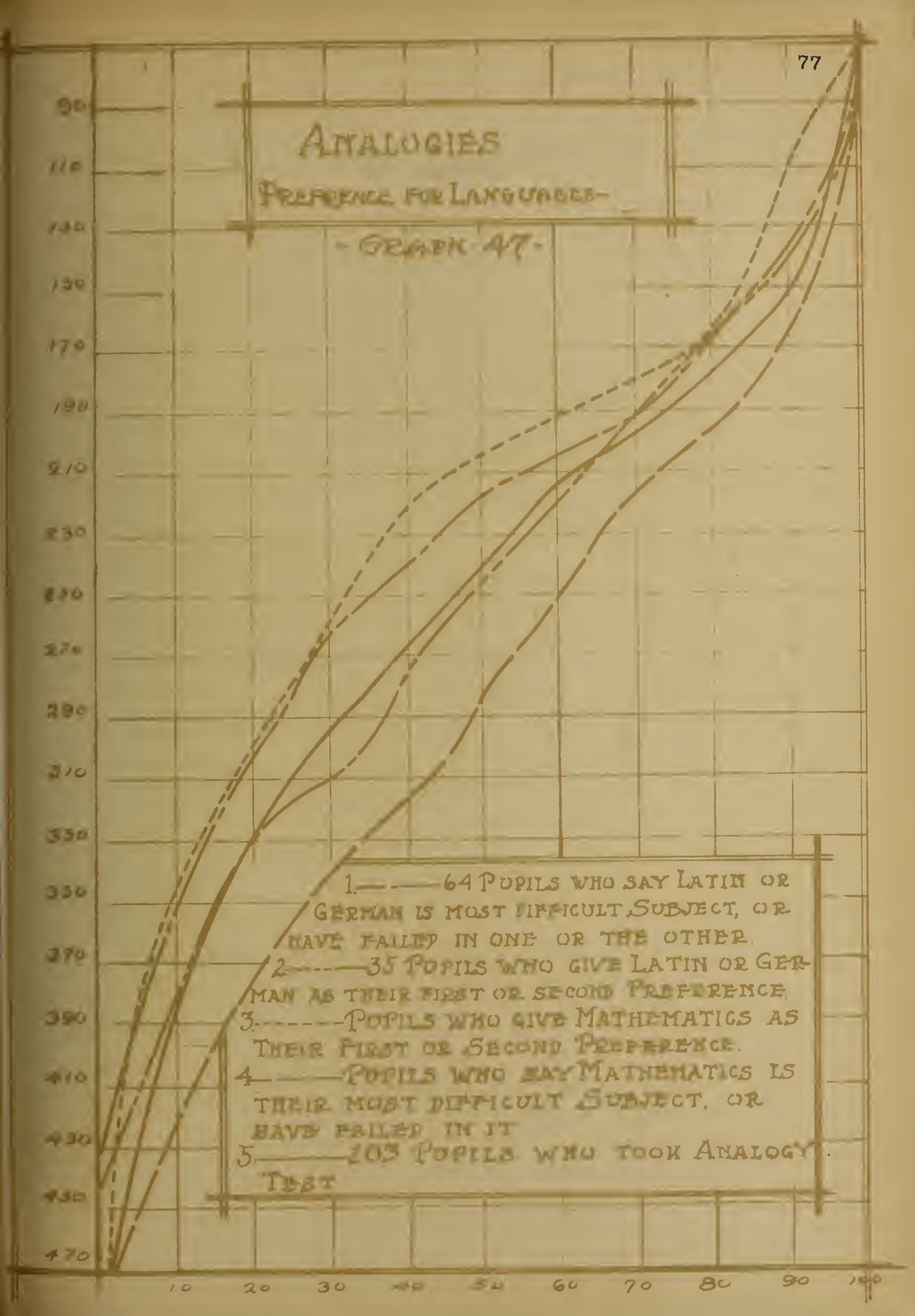
intelligence, but sixty per cent of the students who say Latin or German is their most difficult subject or have failed in one or the other of these subjects, are above the median score of the 203 students who took the analogies test. Those students who prefer languages do poorer in the analogies than those who say Latin or German is their most difficult subject or have failed in one or the other. (See Graph 47). This same condition prevails in all of the tests except the directions test and the word-building test, Graphs 50 and 51.

Significance of the Variation Revealed by the Tests

The range of performance in the tests is expressed in the following ratios between the poorest and the best students:

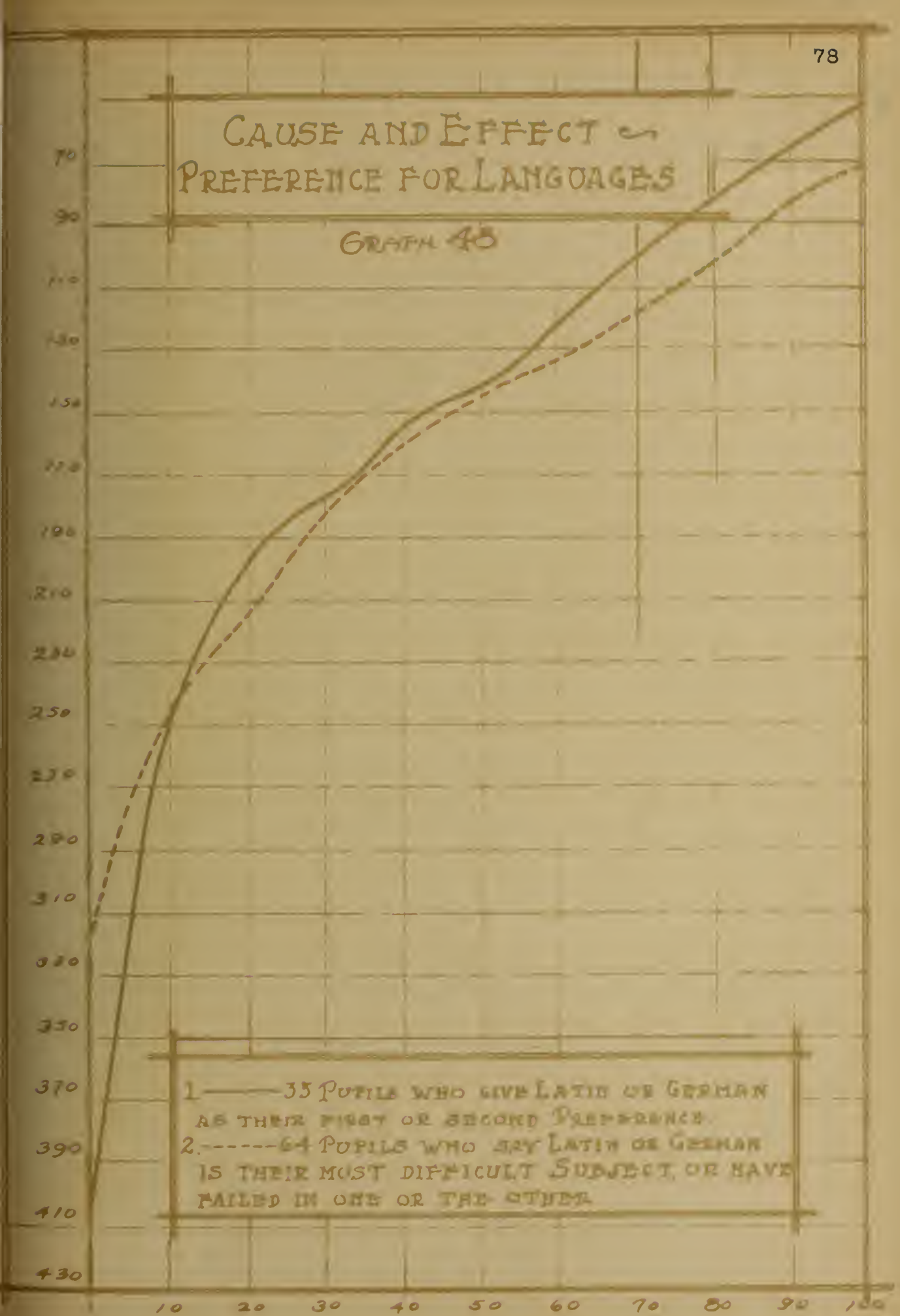
Cancellation	1 : 3.70
Dutch Homestead	1 : 8.30
Marble Statue	1 : 4.28
Analogies	1 : 7.83
Cause and Effect	1 : 7.97
Directions	1 : 9.27
Word Building	1 : 6:00

The range of performance is least in the cancellation test. The variation in this test is probably not very significant. The wide range of performance in the other test sets a serious problem in connection with group instruction. What progress of the class as a whole may we expect when each individual in a heterogenous class is given the same task with a minimum time for its accomplishment? If, for example, the best student in the Dutch Homestead were assigned a lesson requiring one hour for its preparation, it would be reasonable to expect that it would require at least 8.3 hours for the poorest student to prepare the same lesson equally well. If, on the other hand, a lesson were assigned which the poorest student could prepare in one hour, the best student could prepare equally well the same lesson in less than 8 minutes.


ANALOGIES
PREFERENCE FOR LANGUAGES-
- GRADE 4T -
1.——64 PUPILS WHO SAY LATIN OR GERMAN IS MOST DIFFICULT SUBJECT, OR HAVE FAILED IN ONE OR THE OTHER.
2.——35 PUPILS WHO GIVE LATIN OR GERMAN AS THEIR FIRST OR SECOND PREFERENCE.
3.——PUPILS WHO GIVE MATHEMATICS AS THEIR FIRST OR SECOND PREFERENCE.
4.——PUPILS WHO SAY MATHEMATICS IS THEIR MOST DIFFICULT SUBJECT, OR HAVE FAILED IN IT
5.——103 PUPILS WHO TOOK ANALOGY TEST
90
110
130
150
170
190
210
230
250
270
290
310
330
350
370
390
410
430
450
470
10
20
30
40
50
60
70
80
90
100

CAUSE AND EFFECT ~ PREFERENCE FOR LANGUAGES

GRAPH 43



1———35 PUPILS WHO GIVE LATIN OR GERMAN AS THEIR FIRST OR SECOND PREFERENCE.

2.------64 PUPILS WHO SAY LATIN OR GERMAN IS THEIR MOST DIFFICULT SUBJECT, OR HAVE FAILED IN ONE OR THE OTHER.

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OF THE
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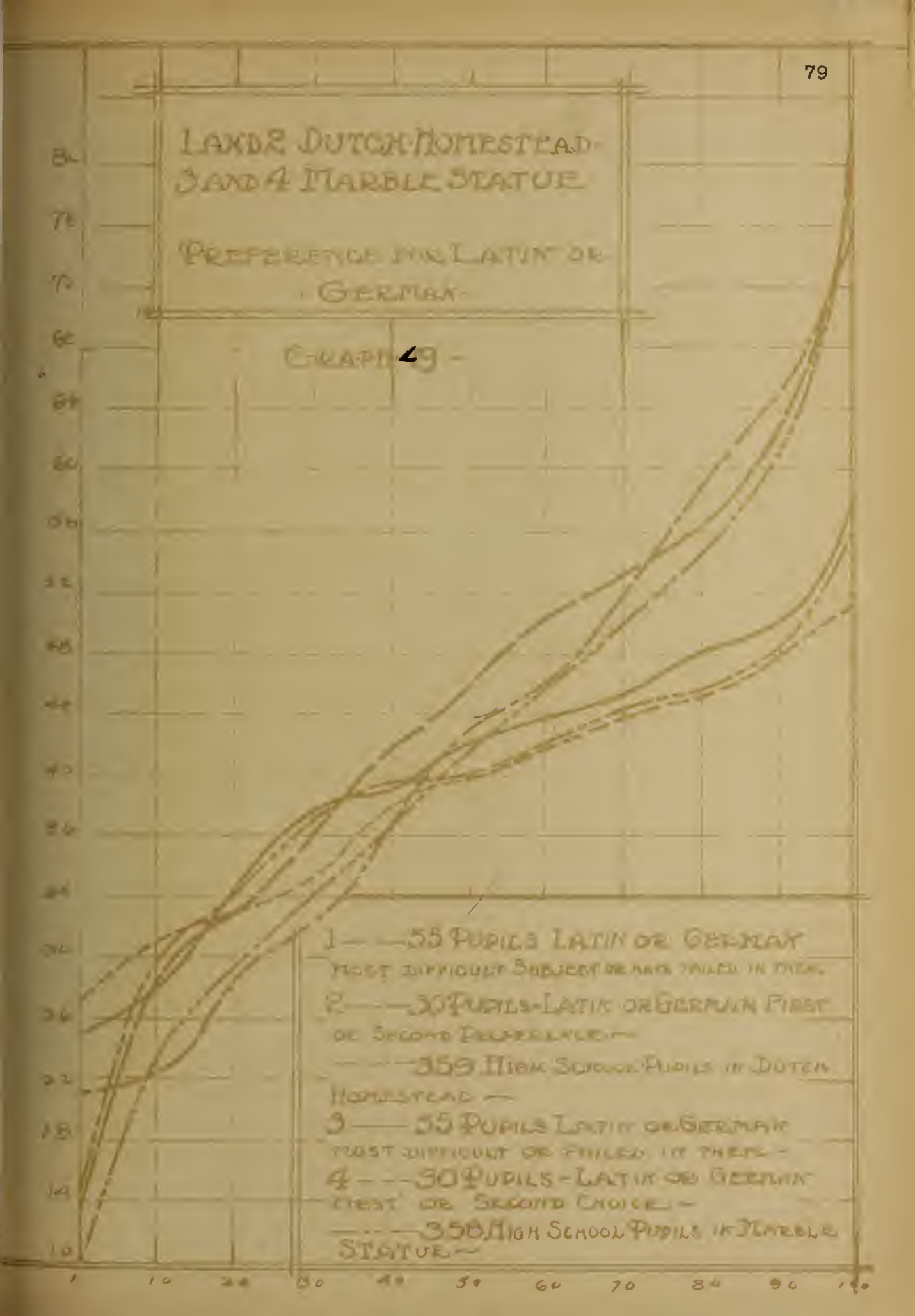
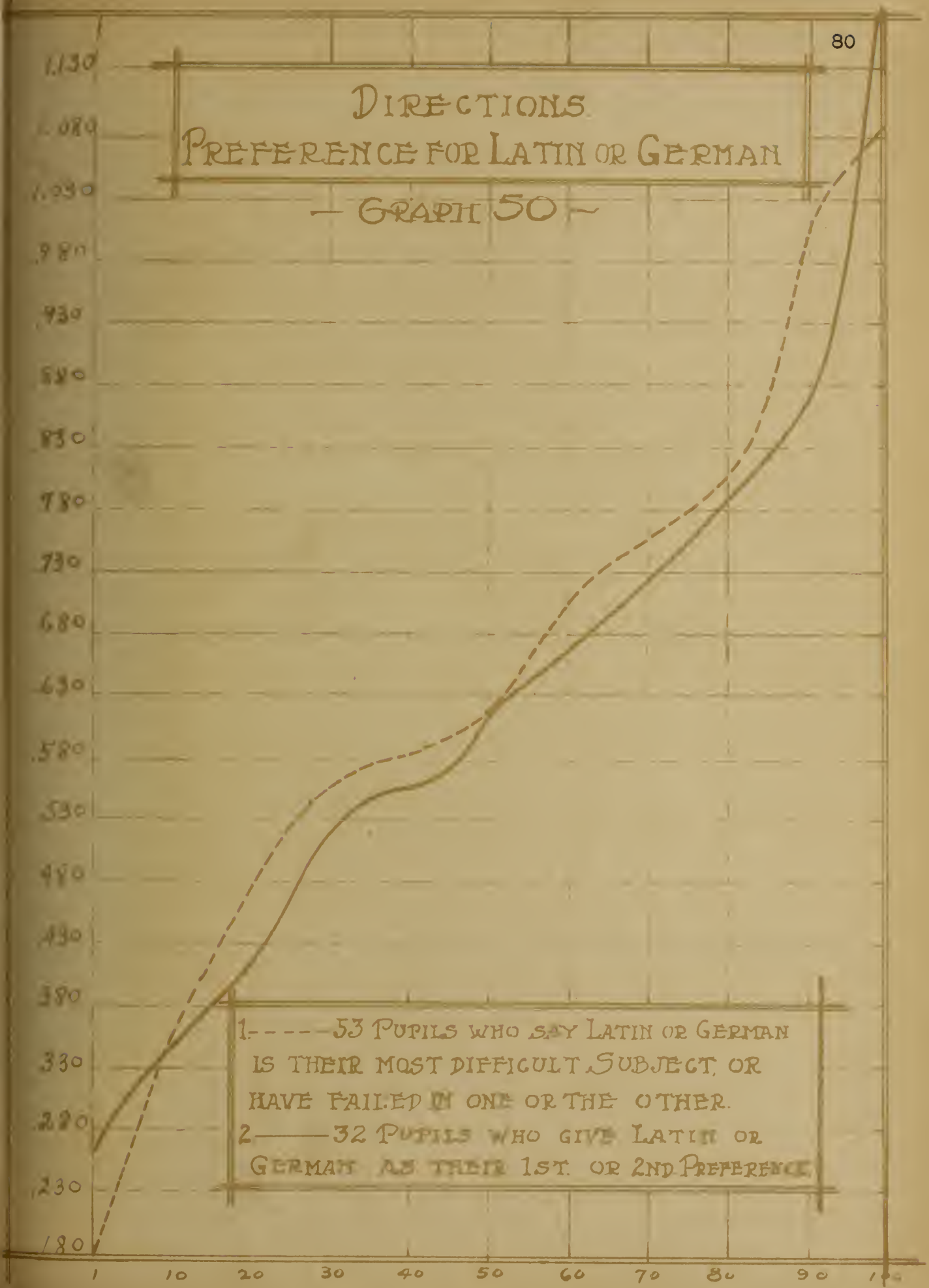
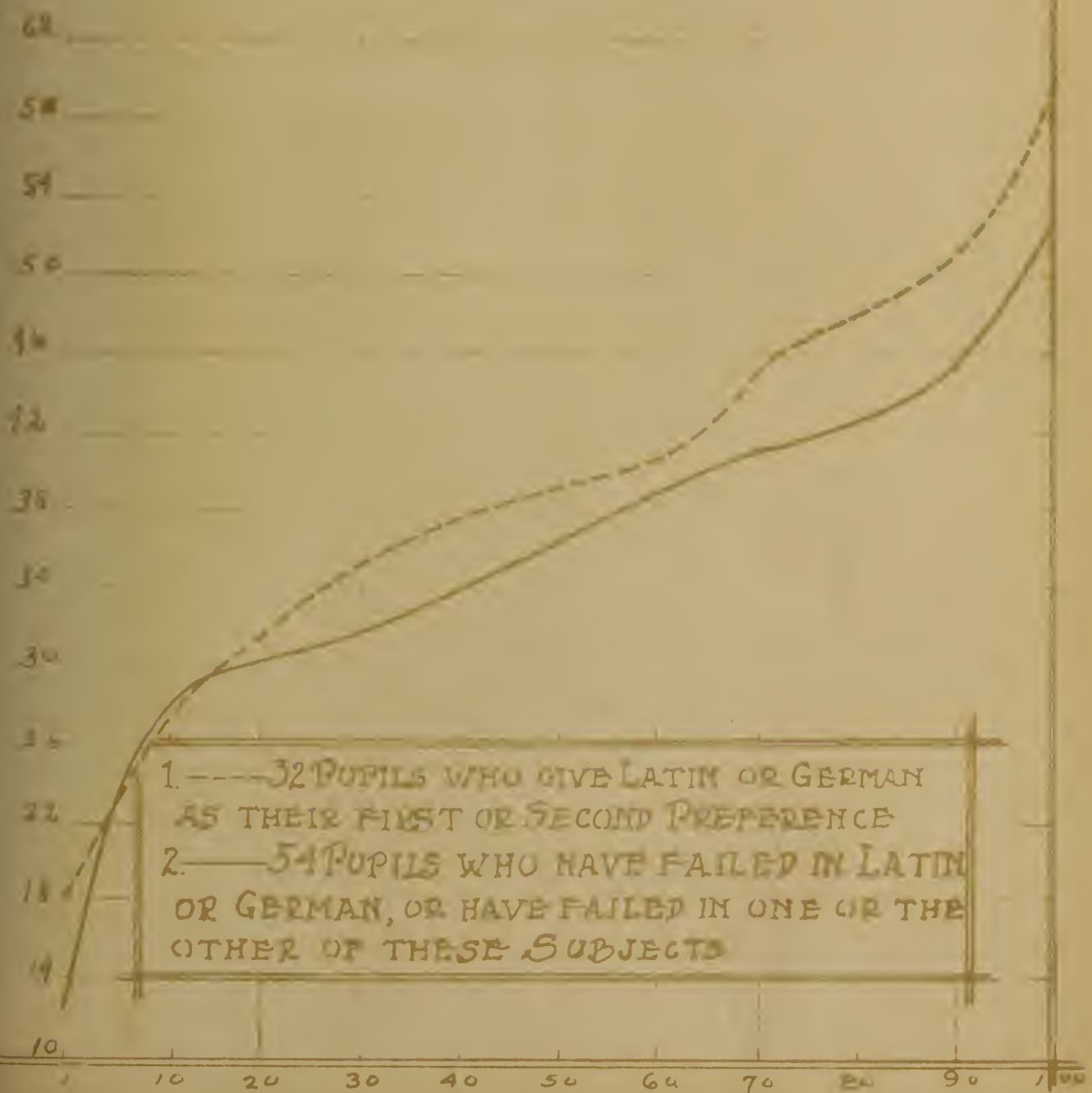

LAND & DUTCH HOMESTEAD
AND A MARBLE STATUE
PREFERENCE FOR LATIN OR
GERMAN
CHAPTER 9 -
1 ——55 PUPILS LATIN OR GERMAN
MOST DIFFICULT SUBJECT OR HAVE FAILED IN THEM.
2 ——30 PUPILS - LATIN OR GERMAN FIRST
OR SECOND PREFERENCE —
——359 HIGH SCHOOL PUPILS IN DUTCH
HOMESTEAD —
3 —— 35 PUPILS LATIN OR GERMAN
MOST DIFFICULT OR FAILED IN THEM -
4 ——30 PUPILS - LATIN OR GERMAN
FIRST OR SECOND CHOICE —
——358 HIGH SCHOOL PUPILS IN MARBLE
STATUE -
1
10
20
30
40
50
60
70
80
90
100

DIRECTIONS
PREFERENCE FOR LATIN OR GERMAN
— GRAPH 50 —



Word Building
Preference for German and Latin
- Grade 5 1 -



1. ----32 Pupils who give Latin or German as their first or second preference
2. ——54 Pupils who have failed in Latin or German, or have failed in one or the other of these subjects

With this wide range of ability it might be suggested that a lesson of such length should be assigned that the median student could prepare it in a reasonable time, let us say 1 hour. Preparation of this lesson suited to the median student would require 4.2 hours by the poorest student while the best student would prepare the same lesson equally well in less than one-half hour.

Further to illustrate the difficulties of group instruction with students that vary so widely in ability, let us imagine the poorest student in the analogies test sitting in an algebra class beside the best student in the same test. The analogies test, it will be remembered, is a test of speed in perceiving relations. Let us assume that success in algebra is dependent upon this ability--an assumption that is justified since the test shows a high positive correlation with performance in algebra. Let us suppose that in order to progress understandingly with the work in the recitation, it is necessary to perceive relations at the rate of one each 10 seconds. The best student as measured by the results of the analogies test can perceive simple relations at a rate of one each 3.5 seconds; the poorest students, measured by the same test, can perceive the same relations at a rate of one each 27.4 seconds. Let us designate the best student as B, and the poorest student as P. B would perceive Relation No. 1 in 3.5 seconds and wait 6.5 seconds for Relation No. 2, but P, if he were not distracted by the presentation of Relation No. 2, would require 27.4 seconds to perceive Relation No. 1. By the time P has grasped Relation No. 1, it is almost time for Relation No. 4, but the perceiving of Relation No. 4, let us assume, is dependent upon his having grasped Relations No. 2 and 3. It is evident that the

recitation would not continue long at this rate before P would be hopelessly lost while B would be bored by the tedium of waiting for each succeeding relation almost twice as long as it took him to perceive the relation when it was presented. With the knowledge of the abilities of B and P which the analogies test affords it would not take a wise man to predict that, if P were held to a standard adapted to B, he would fail to gain credit in the course. If, on the other hand, the recitation progressed at a rate suited to P, B would lose interest and the recitation would fall far short of calling forth the best that was in him. Who can estimate the deadening influence on B of four years of high-school work on this level? What can we expect from P, who must of necessity be completely 'muddled' at the end of each recitation?

If P is to make normal progress, he must be given more time to see relations and to answer thought-questions. This is not advisable if B is to participate in the same recitation. It would, therefore, seem advisable to place P in a class of students who would profit by the long interval that must elapse between question and answer, and to place B in a class of students like himself.

The author is convinced that in classes as organized at present thought-questions are put at a rate too rapid for a large majority of the class. The rate in most classes is more nearly adapted to the best 10 students in 100. Anyone may be convinced of the truth of this statement by observing teachers of freshmen classes in the high school if he will take the trouble to measure with a stop-watch the interval of time allowed for answers to thought-questions. The median time required by freshmen to see the simple relations in the analogies test is about 14 seconds. Most teachers, especially beginners, show considerable uneasiness, at

least, if answers to thought-questions that involve the grasping of relations much more complex than those in our analogies test are not forthcoming before 10 seconds. If the answer is not given almost immediately, the teacher interrupts by meaningless remarks, by a needless repetition of the question, by passing the question on to some other student or by answering the question herself. She can't endure the silence that must prevail while the student is thinking and organizing his material, and commonly feels that she must break the silence by making a remark of some kind, however useless and distracting it may be.

During the past year the author has had occasion to observe the work of over 100 practice teachers; there is no one fault more common than the one under discussion. It is due to the failure to recognize the fact that time is required to perceive thought-relations and that a large proportion of the time in the recitation must be allowed for the exercise of this important function. Fourteen seconds seems a long time to wait for a student to see relations as simple as those in the analogies test, in which the relation when perceived is expressed by a single word and in the presence of one person. Many of the thought-questions put by teachers are much more complex than that and necessitate framing the answer in good connected English and giving it before thirty of his classmates. If the reader is a teacher, he can appreciate this fault to which I refer by putting a thought-question to some member of his class and then measuring with a stop-watch the interval that elapses between the question and the expected answer. It is rare, indeed, that the teacher does not show considerable uneasiness before ten seconds have elapsed.

Miss Stevens* has attacked this problem from a different angle--the number of questions put during a recitation. In the light of the foregoing discussion it is clear why there are reasons for alarm when it is reported that recitations are frequent in which 200 or more questions are asked.

*Romiet Stevens, The Question as a Measure of Efficiency in Instruction, Teachers College, Columbia University Contributions to Education, No. 48.

CORRELATIONS

Spearman's Correlation 'Foot-Rule' or R-Method was used in this study. The formula is $R = 1 - \frac{6\Sigma g}{n^2 - 1}$ The higher correlations are also treated graphically in order that explanations may be made of individuals that show a wide divergence in rank in the two series. Correlations were calculated between:

1. Mental tests and estimated general intelligence by principal and teachers.

2. Mental tests and school performance as measured by school marks.

Mental tests and estimated general intelligence

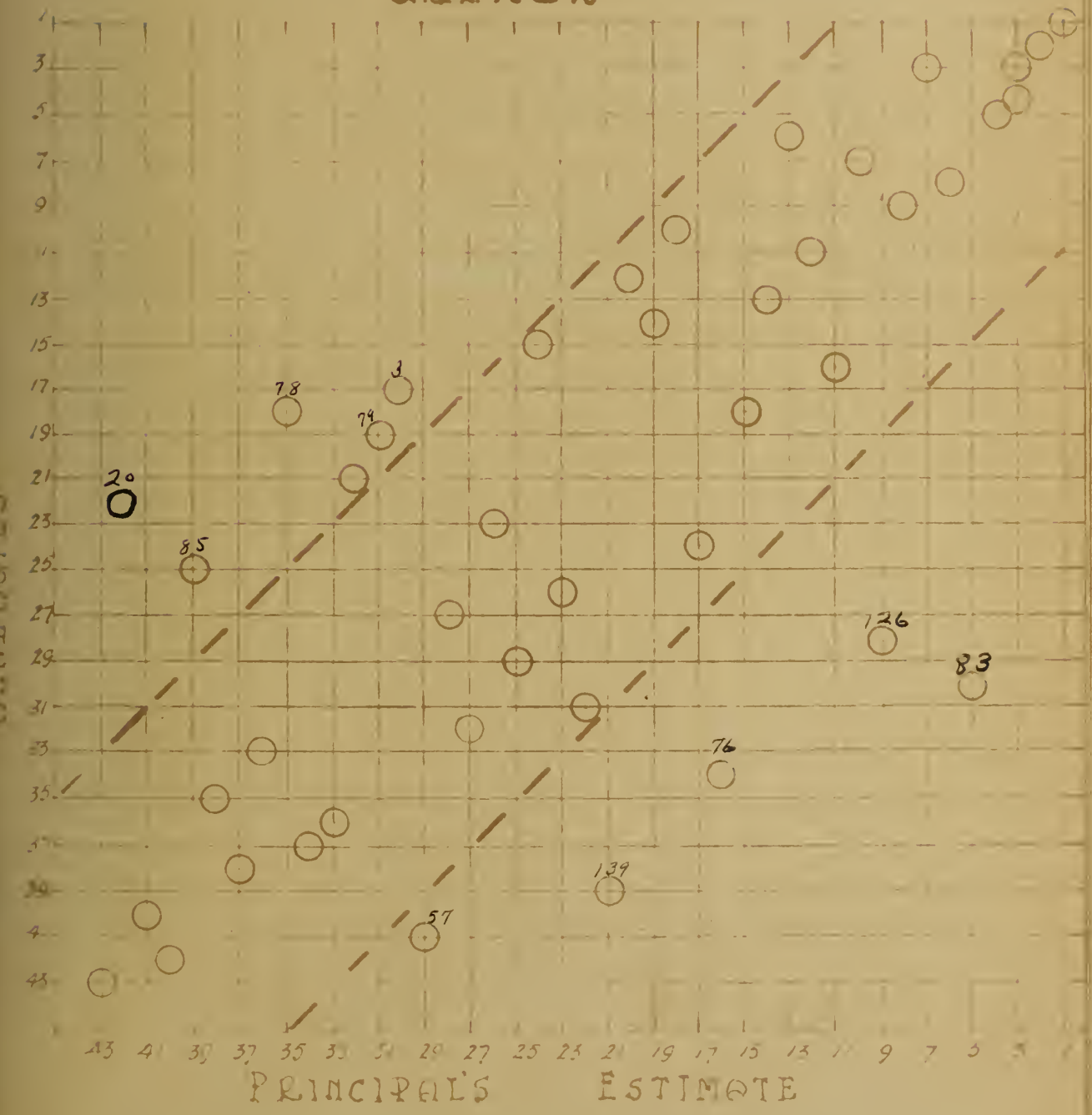
The principal was given cards on which were written the names of the students. He was asked to arrange the cards in order of the general intelligence of the students whose names appeared on them. General intelligence was defined for him as it has been defined in a previous section. He was particularly requested to arrange the cards without reference to the marks on the school register. The principal had had one semester's acquaintance with the students in the freshmen class and seven semesters' acquaintance with the seniors. The same method was used in securing the rank-orders from the teachers.

Correlation Graph 52 shows the relation between rank-order of the principal's estimate of the general intelligence of 43 freshmen and the rank-order as determined by the analogies test. In this graph each circle represents a high-school freshman. If the correlation were +1.00, the circles would all be located on a diagonal extending from the lower left-hand corner, where would be

Analogies With Principals Estimate

43 ~ Freshmen

~ Graph 52 ~



found the poorest student in both rank-orders, to the upper right-hand corner, where the best students in both rank-orders would be found. It will be observed that the circles do group themselves along this diagonal. Especially is this true of the circles within the parallel dotted lines.

But outside of these parallel lines are several circles, the location of which calls for explanations. An effort was made, accordingly, to secure additional information with regard to these particular students.

Case 83 is a girl rated 5 in 43 by the principal and 30 in 43 by the analogies test. Her school marks are above 90 with an average for the semester of 93. Her teachers use the following adjectives* in describing her: prompt, responsible, able, bright, studious, industrious, accurate, enduring, persistent and companionable. She shows high performance in only 3 of the tests, cancellation, Dutch Homestead, and Marble Statue in which she was in the 10th, 8th and 6th deciles, respectively. Three of her teachers rank her as 'average' in general intelligence. Average was defined as the middle 50 students in 100. The author concedes that the principal's estimate, while probably too high, comes nearer the real ability of the girl than does her rank in the analogies test. It must be pointed out, however, that the result of the test would have been better had it not been for the fact that she took the test on the day she returned from a two weeks' illness. We do not expect the mental tests to diagnose convalescence from illness!

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*The author is indebted to Professor Charles Hughes Johnston for the use of his 'Trait Cards' of the high-school students, which had been filled out by the high-school teachers.

Case 126 is rated 9 in 43 by the principal and 28 in 43 by the test. His average school mark is 83, with a range of 79 to 87 (passing mark 75, exemption from examination at 90). The boy is characterized by his teachers as prompt, responsible, average, bright, studious, industrious, accurate, irregular, lazy, quick, persistent and companionable. Three of his teachers say his general intelligence is average, as defined above. There is a strong probability that his intelligence is overrated by the principal.

Case 139 is a girl ranked 21 in 43 by the principal and 39 in 43 by the test. The school records show that she received no mark above 83, that her average mark was 78 and that she barely passed in algebra and physiography. Her teachers' ratings are: dull, average, irregular, lazy, studious. Three of her teachers estimate her general intelligence as below the average.

Case 78, a girl ranked by the principal as 35 in 43 and by the test 18 in 43, needs no explanation since the principal stated after this graph was made that he had in mind another girl by the same name, but spelled differently.

Case 20, a boy, is ranked by the test as 22 in 43 but given by the principal a rank of 42 in 43. In describing him his teachers use the following adjectives: careless, impulsive, lazy, shiftless, average (ability), irregular, adaptable, companionable. This boy is notoriously lazy, an only son and a spoiled one. In this case the principal was doubtless influenced by the boy's attitude toward his work. We believe he has average ability, but is too much of a shirker to produce average results in his school work.

Graph 53 shows the correlation between the analogies test and the estimated general intelligence of 37 sophomores, by the principal.

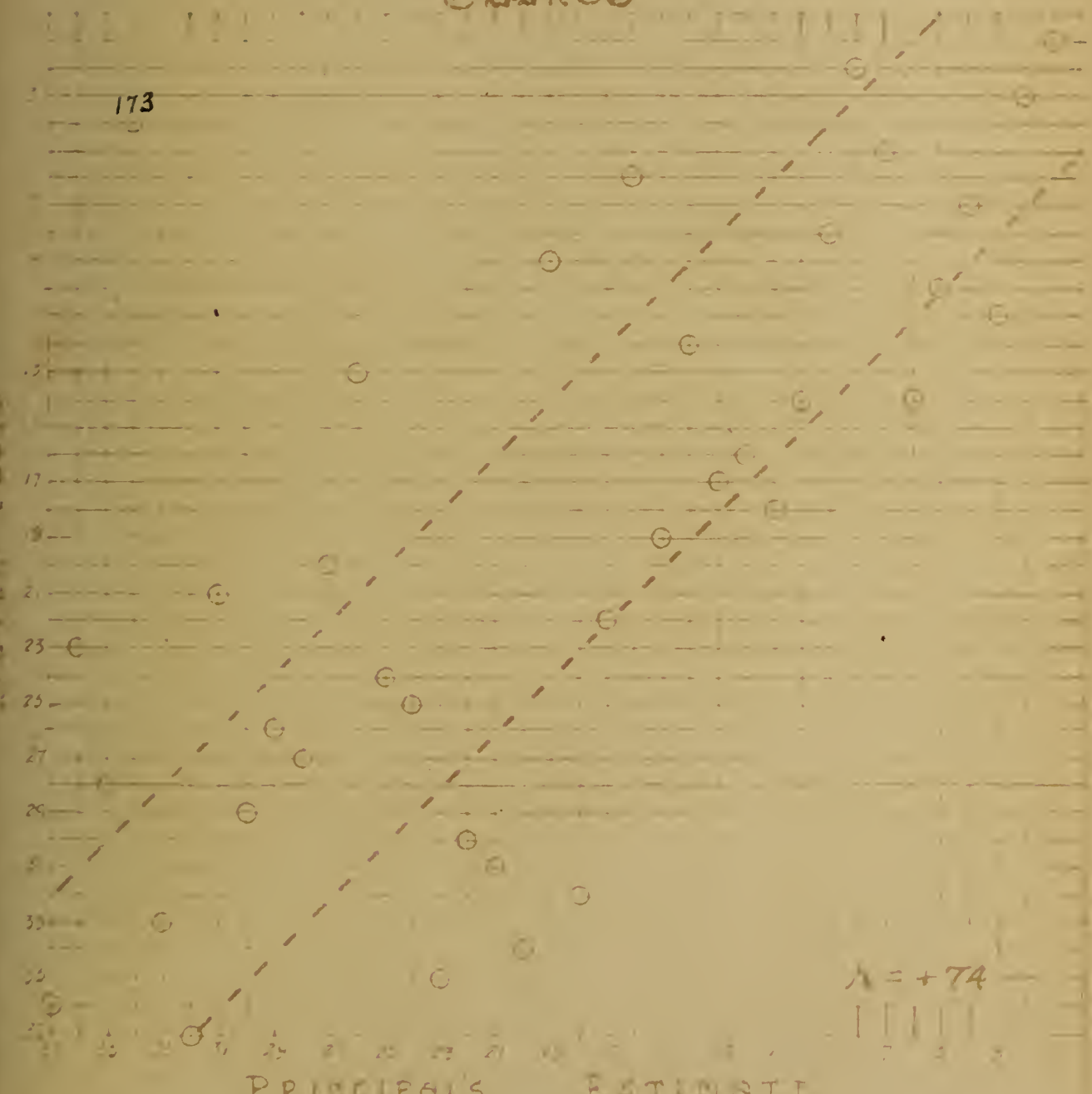
Case 173 is a girl who has made the following marks: 88, 86, 73, 70, 78, 85, 86, 84, 94, 89 and 85. Her dislike for her teacher in mathematics is probably responsible for her mark of failure in algebra. If her marks are any indication of her ability, the principal has probably underestimated her ability. She is a very independent girl with decided likes and dislikes. Her general attitude would not be conducive to good marks.

Graph 54 shows the relation between the analogies test and the pooled rank-order of the estimated general intelligence of 31 freshmen by the principal, the English teacher and the mathematics teacher. The arrows show the amount and direction of variation of the estimations of the principal and the two teachers.

When ability is strikingly superior or inferior, there is an agreement between the estimated general intelligence and that revealed by the test. The greatest disagreement occurs with students of average ability as measured by the test. This probably means that the teachers and principal have been influenced by the zeal and industry of the student. A student of average ability who possessed marked industry or zeal would be ranked by them too high in intelligence while a student of average ability who lacked industry and zeal would be ranked too low.

The tests are in no sense a measure of industry or persistence of motives. To be sure, there is a high correlation between general intelligence and industry, but there are enough exceptions to prevent a perfect correlation between tests of general

SEVEN TESTS
WITH
PRINCIPAL'S ESTIMATE
37 SOPHOMORES
GRAPH 53



ANALOGIES
WITH
POOLED RANK ORDER OF ESTIMATED GENERAL INTELLIGENCE
OF FRESHMEN
GRADE 9A

intelligence and school performance. Superior students get along with a moderate amount of effort and industry and very inferior students do poorly even though they manifest considerable industry. It is with the student of average ability that the presence or absence of industry or zeal counts for most. The grapn confirms this opinion. This point will be made clearer in the discussion of school performance.

Graph 55 shows the correlation between the analogies test and the estimated general intelligence of 34 freshmen by the physiography teacher. The correlation is +.64.

Graph 56 shows the correlation of the analogies test with: (1) The mathematics teachers' estimate of mathematical ability. (2) performance in elementary algebra, (3) the English teacher's estimate of general intelligence, and (4) the principal's estimate of general intelligence.

Attention is called to the agreement in all cases with respect to students of superior and inferior ability, and to the occasional disagreement with respect to students of average ability.

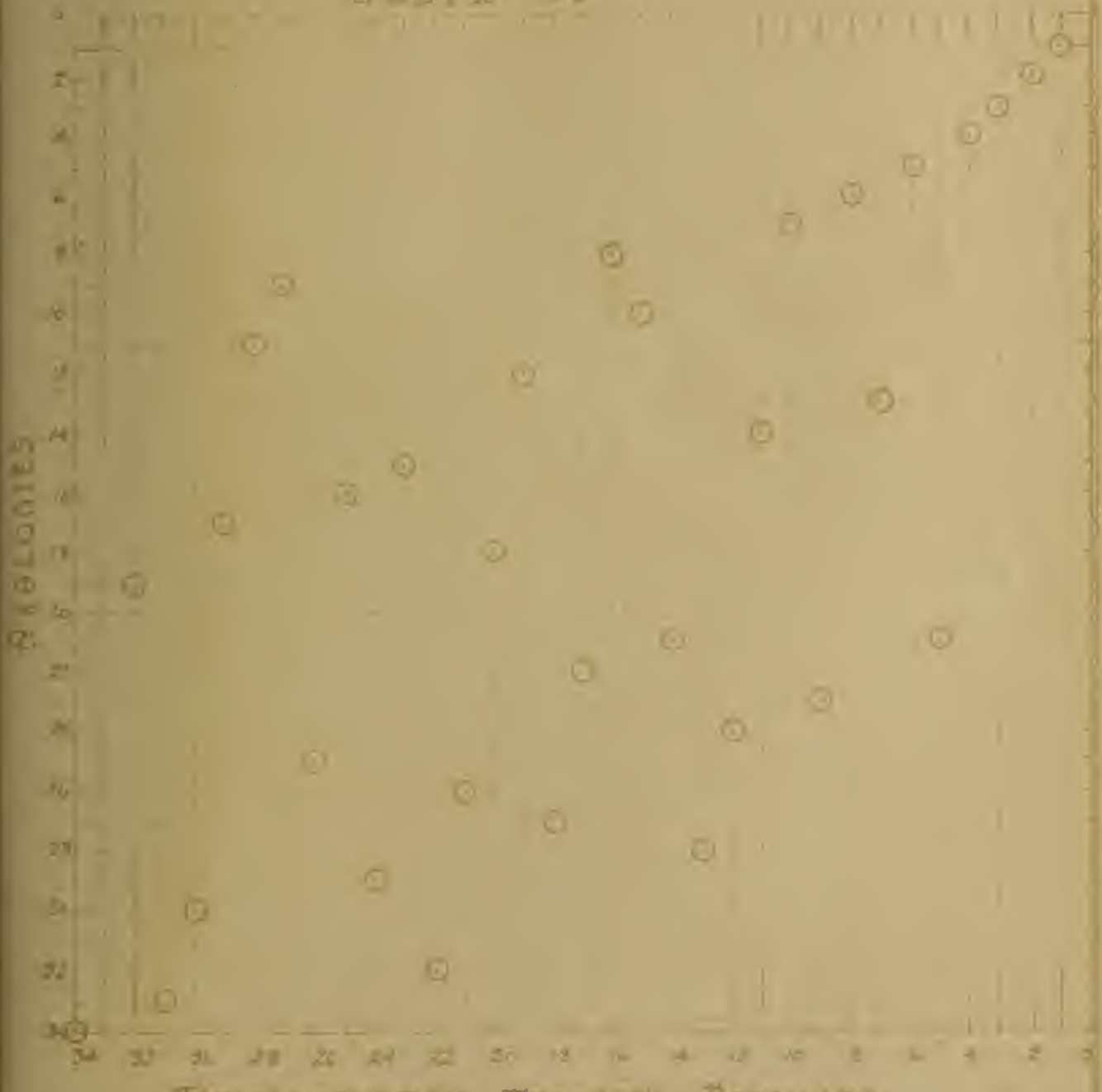
Case 84 missed two months of work on account of absence.

Case 116 is ranked above the average by one of his teachers and average by three others.

Cases 79, 3 and 8 are ranked by their teachers as average in general intelligence and below the average in industry and persistence.

Some explanation other than lack of general intelligence must be offered for the large number of failures in algebra. The distribution of ability as revealed by the test follows closely the normal probability curve, whereas the performance in algebra is not

ANALOGIES
WITH
PHYSIOGRAPHY TEACHERS ESTIMATE
34 FRESHMEN
GRAPH 56



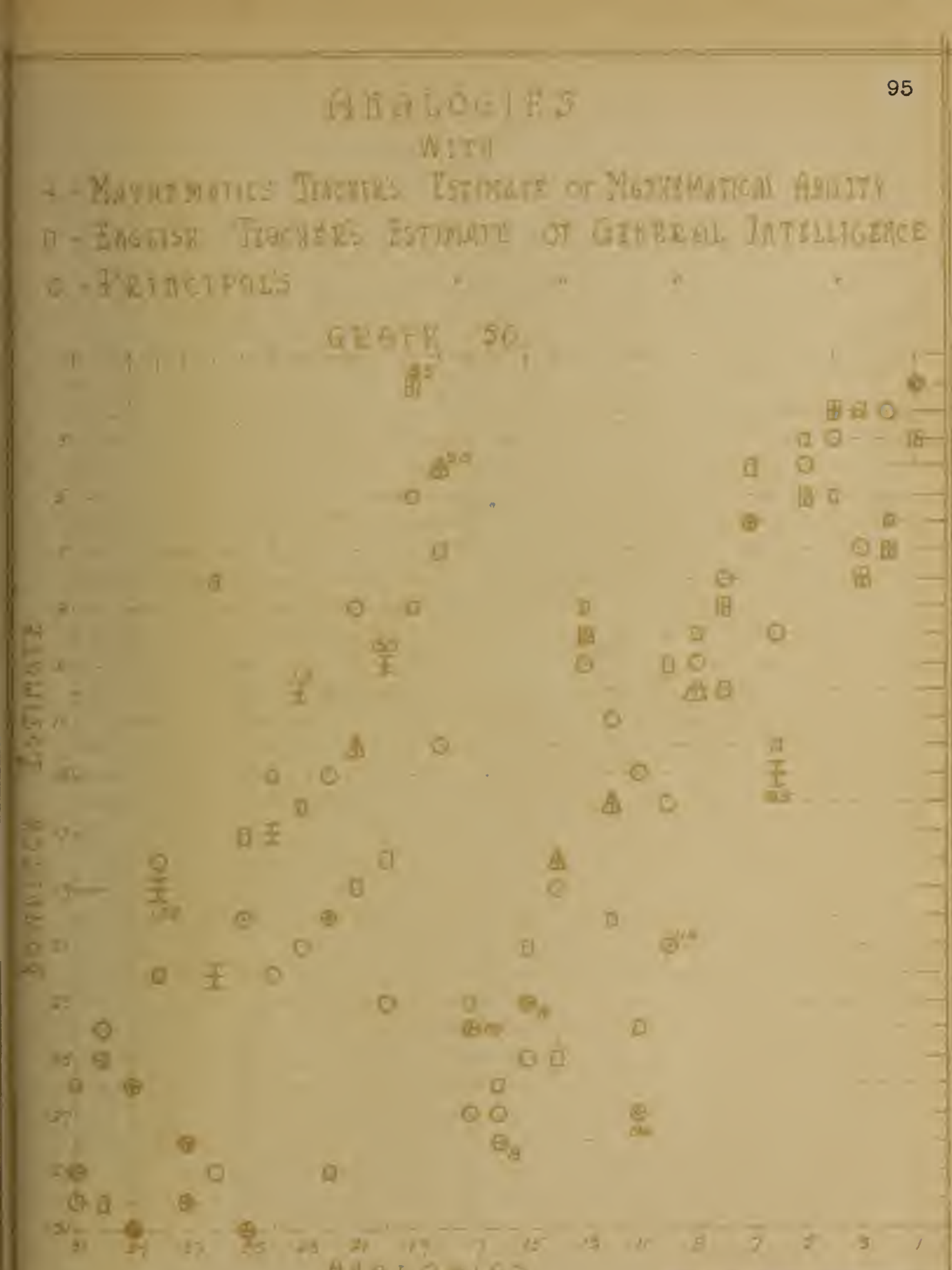
ANALOGIES

WITH

A - MATHEMATICS TEACHER'S ESTIMATE OF MATHEMATICAL ABILITY

B - ENGLISH TEACHER'S ESTIMATE OF GENERAL INTELLIGENCE

C - PRINCIPAL'S " " "



— INDEX —

● = 90 AND ABOVE IN ALGEBRA
▲ = 80-90 IN ALGEBRA
∃ = 75-80 " "
⊖ = FAILURE IN ALGEBRA

ALGEBRA	TEST	SECONDS
2	3	1-5
7	6	5-10
6	14	10-16
11	5	16-20
	3	over 20

what one would expect from a group of students whose ability is so distributed. The failure of the students of average ability is doubtless due to lack of industry; and the relatively high standing of the remainder of the students of average ability is due to the presence of industry. On the basis of the normal probability curve the marks from 80-90 should be most frequent: here they are least frequent. The average score in the analogies test is about 14 seconds. Approximately 50 per cent of the students make this score.

Immediately after applying the analogies and cause and effect tests, which together with the time to fill out the information blank required about 40 minutes, the author attempted to mark the pupils in the 24 characteristics mentioned on the card below.

Please grade.....on the 24 characteristics listed on the reverse side of this card. The grade should be made on a basis of *five* points. If the person appears to you as *average* i. e., as possessing the characteristic as you would expect it to appear in 50 persons out of 100, give a grade of 3. Give a grade of 5 only when the person possesses the characteristic in so high a degree as you would expect it in 5 persons out of 100. Use 1 to indicate the other extreme, and 2 and 4 for degrees of the characteristic between the average and the extremes. Place a grade opposite each characteristic in the column marked (0).

	0	1	2	3	4	5
1. Accuracy						
2. Candor						
3. Capacity to attend						
4. Cheerfulness						
5. Co-operation						
6. Courage						
7. Courtesy						
8. Endurance						
9. Honesty						
10. Improvement						
11. Industry						
12. Leadership						
13. Loyalty						
14. Originality						
15. Persistence						
16. Poise						
17. Punctuality						
18. Pride in work						
19. Self-Confidence						
20. Sincerity						
21. Sympathy						
22. System						
23. Tact						
24. General Intelligence						

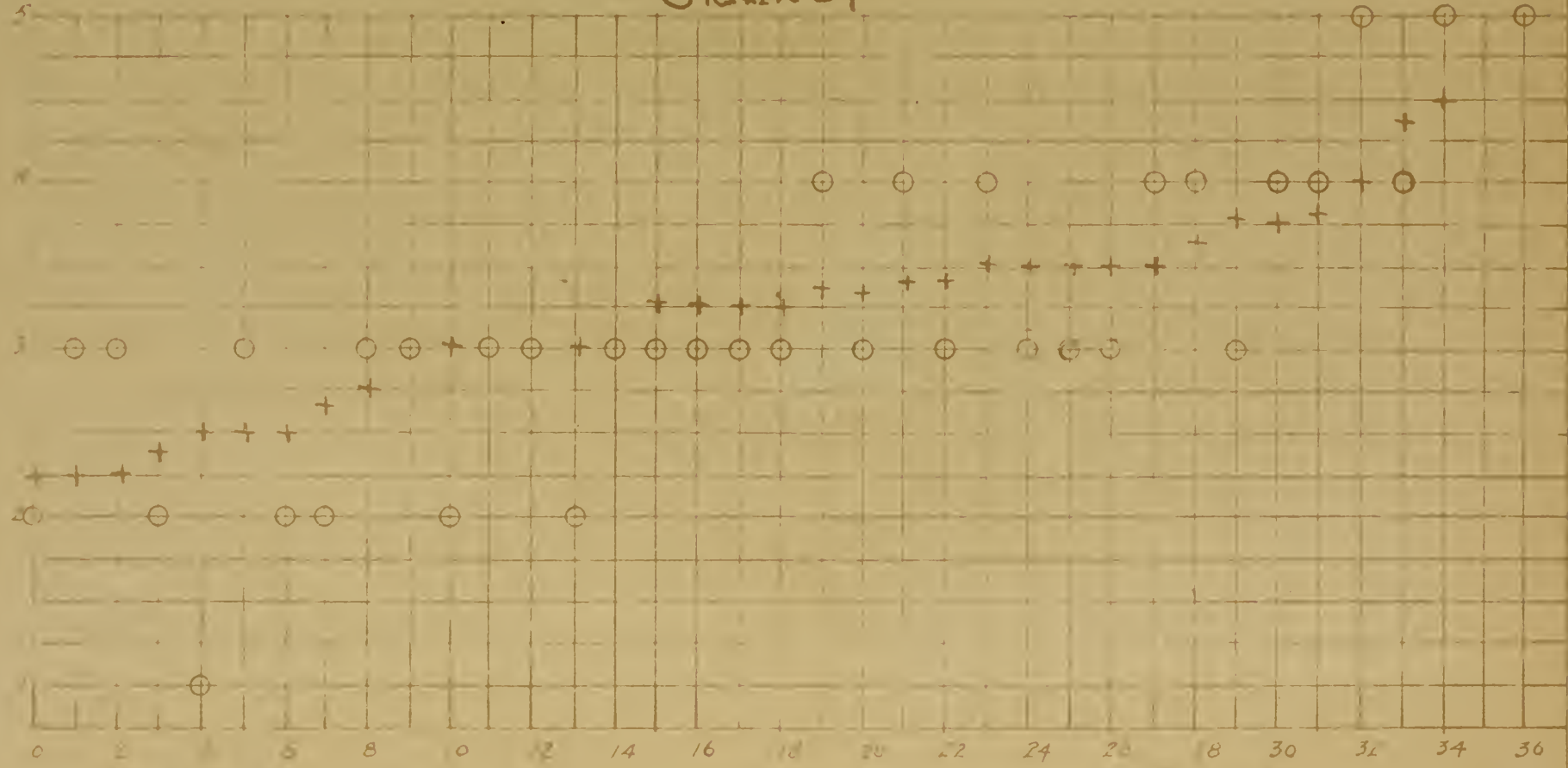
The teachers were asked to mark the students in the same characteristics. The object was to test the possibility of forming a reliable estimate of a student from a brief interview. The estimate by the author was made before the tests were scored. Graph 57 shows the results in regard to one characteristic, general intelligence, with 36 students who were rated by from 3 to 5 teachers. The abscissae represent the pooled rank-order of the teachers, the ordinates the degrees of general intelligence: "x" represents the combined estimate of the several teachers, "o" the estimate of the author. It is quite evident from the graph that there is a decided agreement between the two estimates. Students receiving a rating by the teachers of 2 to 3, inclusive, are rated 2 and 3 by the author with one exception, Number 4. Students receiving a rating of 3 to 4,inclusive, by the teachers are rated 3 and 4 by the author, and students receiving a rating of 4 to 5, inclusive, by the teachers are ranked 4 and 5 by the author.

With the other 23 characteristics the agreement is quite as marked. Although the variation in the judgment of the teachers is naturally well marked in some cases, the author's rating in practically every instance agrees with that of the majority of the teachers.

If one studies a student carefully for even so brief a period, it is possible to form a judgment quite as reliable as that of a teacher based upon a much longer acquaintance.

In many cases there was evidence of either poor judgment on the part of some of the teachers or lack of information that would serve as a basis of judgment. The author believes that the high-school teachers should attempt to gain an acquaintance with

ESTIMATED
- GENERAL - INTELLIGENCE -
- GRAPH 57 -



+ - POOLED RANK ORDER OF GENERAL INTELLIGENCE BY 3 TO 5 TEACHERS
O - EXPERIMENTOR'S ESTIMATE.

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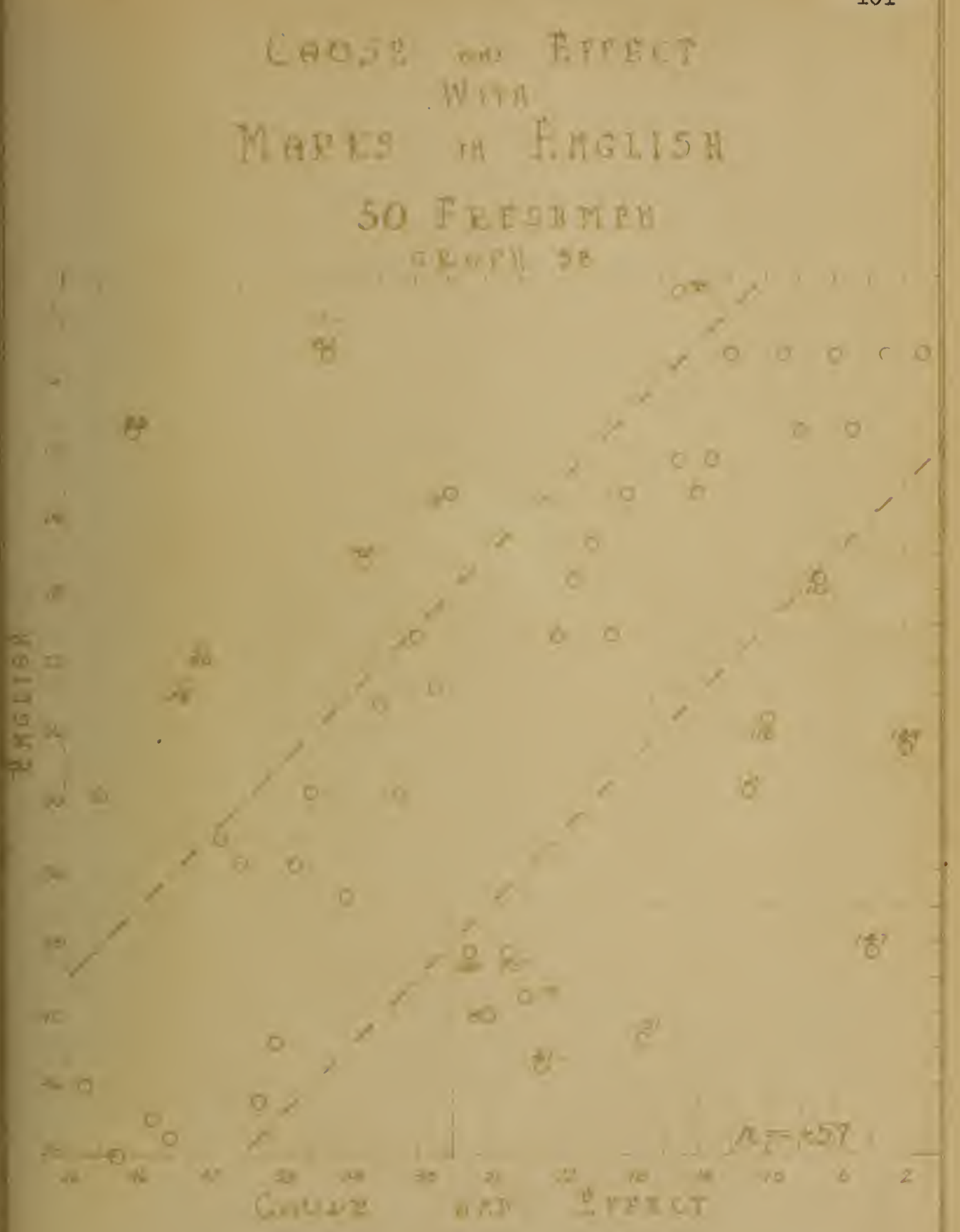
their students that would enable them to form a judgment in regard to these and other characteristics. It should not be impossible to rate students in these characteristics. Such a rating would be quite as valuable as a rating in performance alone. In fact, in many cases there are reasons to believe that the mark in performance is so much colored by these various characteristics as to render the supposed mark in performance unintelligible as such. It is important to know that a student is honest, persevering and courteous, but the fact that he is honest, persevering and courteous should not modify the mark of his performance in algebra, Latin, etc. The author is now trying to construct a report card on which will be recorded ratings in these positive virtues as well as ratings in performance.

MENTAL TESTS AND SCHOOL MARKS

In Graph No. 58 is represented the correlation between the cause and effect test and the marks in English for the first semester. The same conditions are found here that were found in the correlation between the analogies test and the algebra marks. The disagreement in the two rank-orders is widest with the students of average ability, which suggests that the English teacher was influenced by the industry of the students in her marking.

It is true, however, that 9 of the 12 students who received 90 or above in English were above fifteenth rank in the cause and effect test. Six of the 10 failures were below thirty-seventh rank in the test. Seventeen of the 25 students who received a mark between 75 and 86 (median mark 81) were in the middle 50 per cent in the test. Four of the ten students who failed were of about average ability as measured by the test.


CAUSE AND EFFECT
WITH
MARKS IN ENGLISH
50 FRESHMEN
GROUP 38
ENGLISH
CAUSE
EFFECT

Case 54 was ranked average in general intelligence by 3 of his teachers and above average by a fourth. Case 8 was ranked above the average by one teacher, average by another and below average by another. Case 21 was ranked average by one teacher, and below average by another. Case 151 was ranked average by 4 of her teachers. She had an operation for appendicitis during the semester. For some reason the test failed to rank Case 98 properly. Case 147 was ranked below average in general intelligence by two of his teachers, average by one, and above the average by another. Case 124 was ranked as in the top 5 in 100 by one teacher, above the average by two others, and average by two others. Case 126 was ranked above the average by two teachers, and average by three. Case 9 was ranked average by two teachers, and above average by one. Case 148 was ranked as in the top 5 in 100 by one teacher, average by two teachers and above the average by one teacher and the writer. She is probably more capable than the cause and effect test indicates. Case 90 is ranked below average by one teacher, and average by another. Case 76 is a colored boy ranked average by three of his teachers. Case 83 is the girl who took the analogies and cause and effect tests the day she returned from a two weeks' illness.

When we take into account the ranking of the exceptional cases by the teachers, there is reason to believe that the test gives quite as reliable ranking of these 50 freshmen as does the English teacher.

The distribution of the pupils by the cause and effect test is more in keeping with what one would expect. It will be observed that almost exactly 50 per cent of the students group

about the median score in the test, while only a third of the students receive the mark that should be most frequent with the marking system used in the English work.

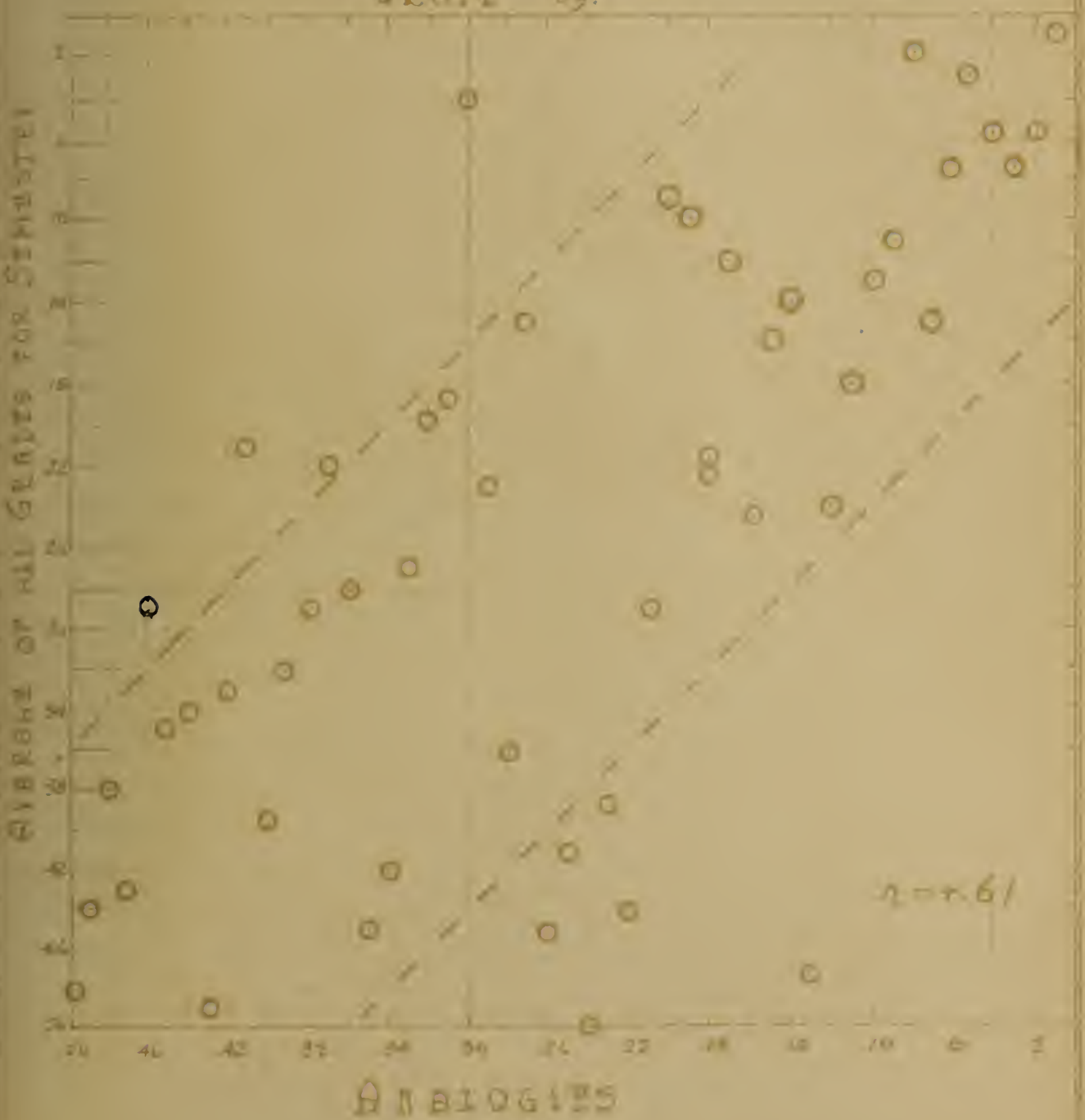
Graph 59 showing the correlation between the analogies test and the average of all marks for the first semester, pictures again the wide variation in performance of pupils of average ability. Reference to the teachers' rankings of general intelligence confirms the test's ranking of Cases 20, 8, 79, 3, 147, and 151. Case 151 was the girl who had the operation for appendicitis. The low average mark here is, in the judgment of the teachers, due to lack of industry rather than to lack of general intelligence. The distance between this group and the upper group, Cases 148, 75, 98 and 83, is a measure of the difference in industry and zeal of the two groups.

In Graph 60 is represented the correlation between the pooled rank-order of the 7 tests and the average of all marks of 36 seniors. This correlation is +.51 in spite of the fact that much of the school work was done long before the tests were applied.

A very interesting fact is revealed in this graph, which confirms the statement that has been made in regard to the influence of zeal and industry. The students in the upper left-hand square are above the median in the tests, but below the median in school marks. The students in the lower right-hand square are below the median in the test, but above the median in school marks. It is significant that the students in the former group are all boys and in the latter group all girls. Any one who knows high-school boys and girls will now be convinced that industry or appli-

Analogies
With
Average of all Marks
50 Freshmen

Graph 39.



Seven Tests
With
Average of all Marks
Four Years High School
36 Seniors
Grade 10

cation is the factor that prevents a higher correlation between general intelligence and school marks. The characterizarion of the students in these two groups will throw some light on the point under discussion.

Case 82 is characterized by her teachers as prompt, responsible, persistent, studious, "digs unintermittently, worries." If the test really measures her ability, there would certainly be need for worry in order to bring her performance to first place in the group.

Case 198, is, according to her teachers, prompt, responsible, studious and persistent. Cases 113, 197, and 41 are characterized by exactly the same adjectives.

The boys in the upper left-hand square, while rated average and above in general intelligence, are described by their teachers as irregular, impulsive, lazy and careless. Case 87, who is characterized by his teachers as bright, studious, industrious and original, confided to the writer that he was addicted to the cigarette habit.

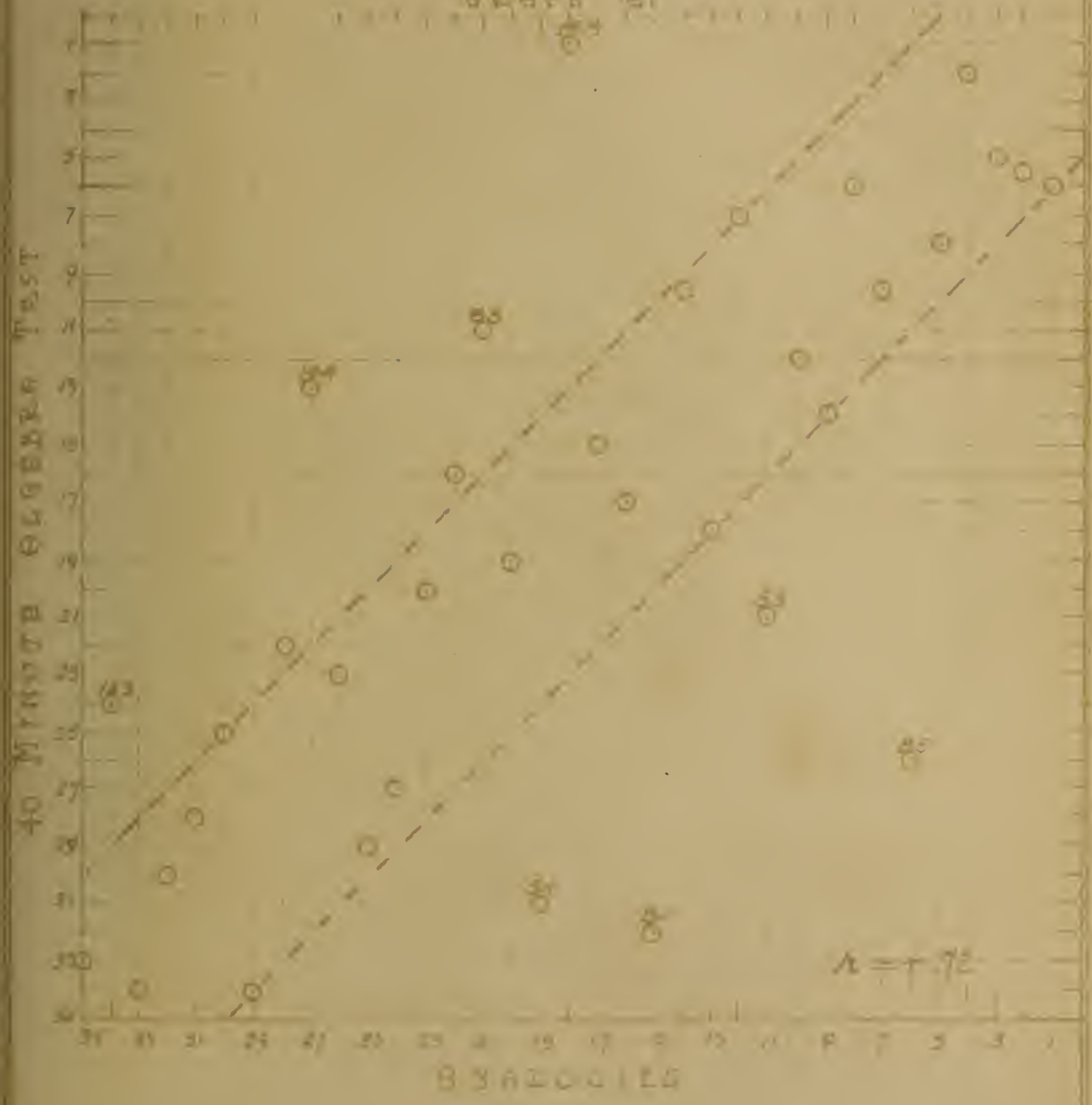
With the idea in mind that the marks in algebra were not an accurate measure of ability in this subject--that some students might conform to certain requirements in the way of handing in solutions to problems assigned for home work and receive a mark not all their own, that others who understood the principles thoroughly would not comply with the requirements necessary to receive a good mark--the writer decided to apply a standard test in algebra in order to secure a ranking of these students on the basis of 40 minutes of independent work on algebra problems which were supposed to cover the important principles that a freshman class

should know. For this purpose Dr. H. O. Rugg's test, Series B, was used. The students were allowed 40 minutes to solve as many of the problems as they could in that time. The test was scored for number of problems attempted and number solved correctly. An index was obtained by dividing number solved correctly by number attempted.

Graph 61 shows the correlation between the rank-order in the test and the rank-order in the analogies test. Case 83, as explained before, took the test on the day she returned to school after a two weeks' illness. Case 84 missed 2 months of algebra on account of absence. Case 53 was reciting 7 periods daily. She cared for children for her board and room. By one of her teachers she was ranked as in the top 5 in 100, by two others she was ranked above the average, and by another as in the bottom 5 in 100! The following quotation from notes taken by the writer during the test will probably explain the ranks of Cases 54 and 85: "Worked very ineffectively - looking around most of the time-didn't take hold." The average of Case 148 in the analogies test was 12.1 seconds; her median score was 4.9 seconds, which means that she had a few delayed responses. The average was used to determine the rank-order in the analogies test. Her median score would place her much higher in the list. Case 153 attempted only 13 problems. Case 144 is ranked above average in general intelligence by 3 of his teachers and average by a fourth.

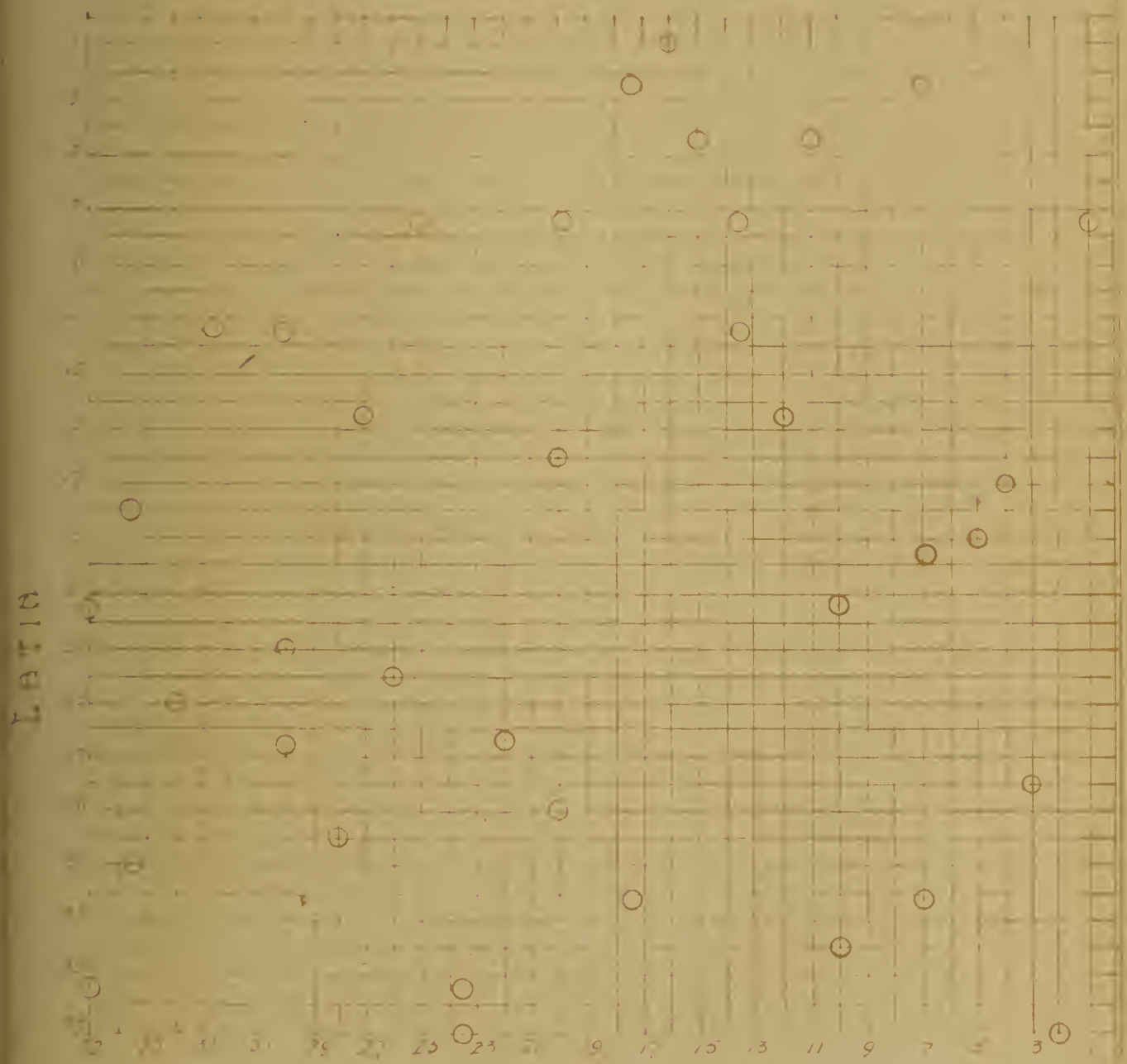
The graphs that have been presented were selected because of the high correlation which they reveal and for the purpose of explaining the apparent exceptional cases. Graphs 62 and 63 are typical of the lower correlations. The memory tests

ANALOGIES
WITH
ALGEBRA TEST
55 FRESHMEN
GRAPH 61



DUTCH HOMESTEAD WITH MARKS IN LATIN

~ GRAPH 62 ~



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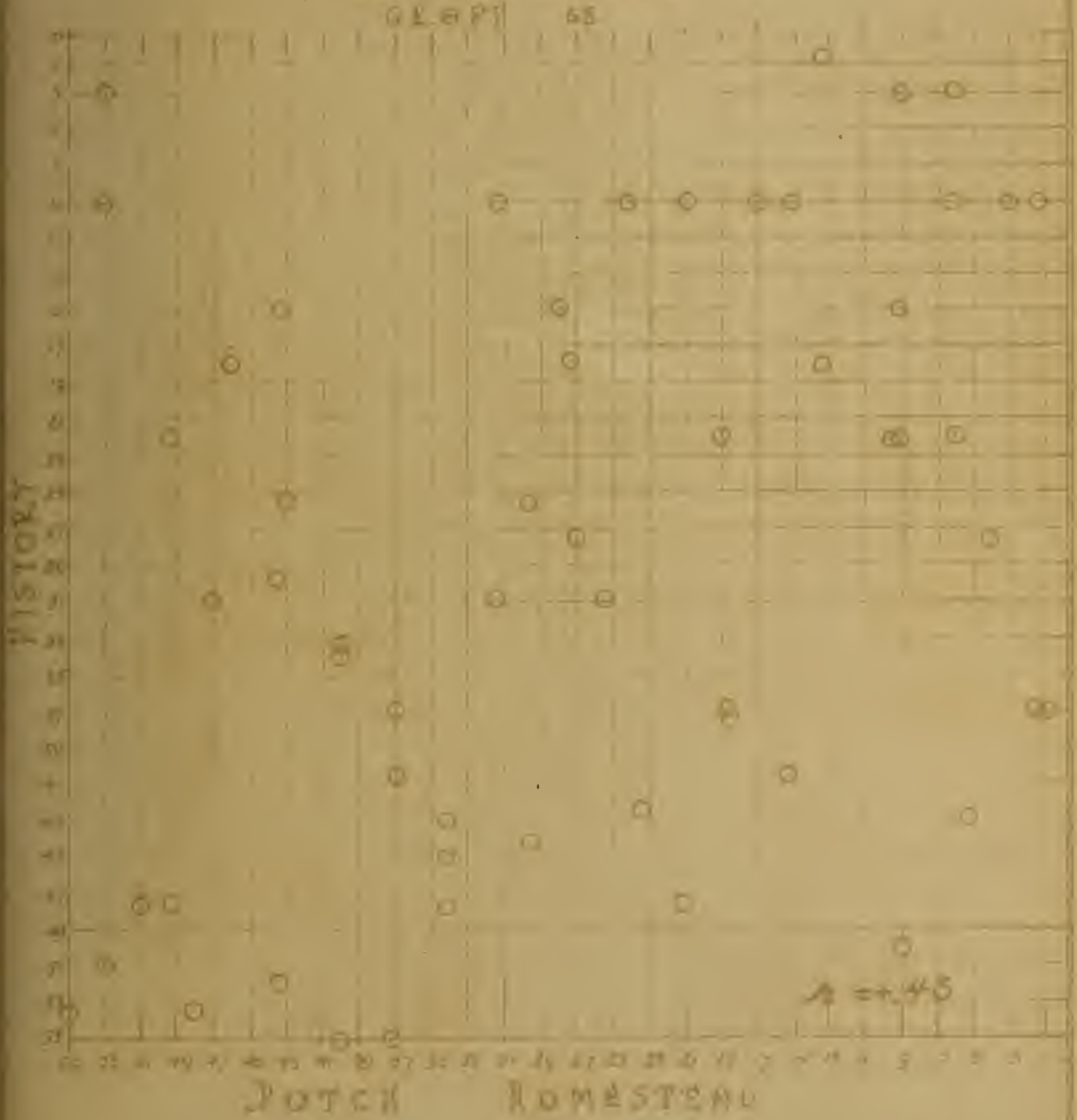
DUTCH HOMESTEAD
WITH
ANCIENT HISTORY
55 - FOREMEN



do not correlate so well with general intelligence, neither do they show the high correlation with school marks in language and history that had been expected.

The following are the correlations that have been calculated for the other tests:

ANALOGIES TEST

Correlated with	Cases	r
1. Algebra 1	23 freshman girls	+.50
	27 freshman boys	+.57
2. Algebra 1	50 freshmen	+.59
3. Algebra 1 (Cases 83 and 1 excluded)	44 freshmen	+.71
4. Algebra 1	50 seniors	+.29
5. Mathematics teacher's estimate mathematical ability	31 freshmen	+.51
6. Plane Geometry	50 seniors	+.55
7. 40 minute algebra test (Rugg's B series)	35 freshmen	+.72
8. English 1	50 freshmen	+.52
9. English 1	50 sophomores	+.47
10. English 1	50 seniors	+.28
11. English 4	50 seniors	+.14
12. English teacher's estimate of general intelligence	43 freshmen	+.61
13. Average 3 semesters' English	50 sophomores	+.48
14. United States history	50 seniors	+.03
15. Average physics, chemistry and mathematics III	48 seniors	+.52
16. Average, all language marks	48 seniors	+.29

ANALOGIES TEST, continued.

Correlated with	Cases	r
17. Average, all marks	50 freshmen	+.61
18. Average, all marks except music and drawing	50 seniors	+.35
19. Average, all marks except music and drawing	50 seniors with 3 or more years in Urbana	.38
20. Principal's estimate of general intelligence	43 freshmen	+.74
21. Cancellation	45 freshmen	-.03
22. Directions	38 freshmen	+.37
23. Word Building	38 freshmen	+.31
24. Cause and Effect	50 freshmen	+.56
25. Cause and Effect	50 sophomores	+.59
26. Cause and Effect	50 juniors	+.45
27. Cause and Effect	50 seniors	.00

CAUSE AND EFFECT TEST

Correlated with	Cases	r
28. English 1	50 freshmen	+.57
29. Average 3 semesters' English	50 sophomores	+.60
30. English 1	50 sophomores	+.51
31. English 1	50 seniors	+.32
32. English 4	50 seniors	+.26
33. Average all marks except music and drawing	50 seniors	+.13
34. Average all language marks	48 seniors	+.01
35. Average chemistry, physics and mathematics 3	48 seniors	+.16
36. English teacher's estimate of general intelligence	43 freshmen	+.57

CAUSE AND EFFECT TEST, continued.

Correlated with	Cases	r
37. Cancellation	23 freshman boys	+.22
38. Cancellation	22 freshmen girls	+.29

DUTCH HOMESTEAD

Correlated with	Cases	r
39. Marble Statue	48 freshmen	+.48
40. Marble Statue	358 high-school students	+.51
41. Latin 1	38 freshmen	+.08
42. Ancient History	56 freshmen	+.43

MARBLE STATUE

Correlated with	Cases	r
43. Latin 1	38 freshmen	+.25
44. Ancient History	56 freshmen	+.29

POOLED RANK-ORDER OF DUTCH HOMESTEAD AND MARBLE STATUE

Correlated with	Cases	r
45. Latin 1	38 freshmen	+.19

POOLED RANK-ORDER OF ANALOGIES AND CAUSE AND EFFECT

Correlated with	Cases	r
46. English 1	50 freshmen	+.57
47. Average 3 semesters' English	50 sophomores	+.56
48. Algebra 1	23 juniors	+.54
49. Algebra 1	29 sophomores	+.54
50. Principal's estimate of general intelligence	43 freshmen	+.69

POOLED RANK-ORDER OF THE SEVEN TESTS

Correlated with	Cases	r
51. Principal's estimate of general intelligence	38 freshmen	+.64
52. Principal's estimate of general intelligence	37 sophomores	+.69
53. Principal's estimate of general intelligence	32 juniors	+.28
54. Principal's estimate of general intelligence	36 seniors	+.41
55. Average 4 years' marks	36 seniors	+.50

CORRELATION OF POOLED RANK-ORDER OF THE SEVEN TESTS

WITH TESTS	1	2	3	4	5	6	7
38 freshmen	+.06	+.66	+.71	+.66	+.80	+.78	+.56
37 sophomores	.00	+.67	+.51	+.66	+.73	+.78	+.41
32 juniors	.17	+.44	+.35	+.41	+.31	+.37	+.50
36 seniors	.64	+.40	+.51	+.57	+.55	+.45	+.29
Average	+.22	+.54	+.51	+.58	+.60	+.60	+.44

CORRELATION OF PRINCIPAL'S ESTIMATE OF GENERAL INTELLIGENCE WITH TESTS

	1	2	3	4	5	6	7
38 freshmen	-.05	+.40	+.51	+.57	+.55	+.45	+.29
37 sophomores	+.08	+.56	+.28	+.54	+.71	+.55	+.41
32 juniors	-.03	+.16	+.16	+.19	+.40	+.11	-.08
36 seniors	+.51	+.35	+.11	+.60	+.19	+.35	+.19
Average		+.37	+.27	+.48	+.46	+.37	

According to the formula, $P.E._R = \frac{.43}{\sqrt{n}}$ the probable error for the correlations listed above would range from $\pm$.05 to $\pm$.08.

Intercorrelations of Tests, Calculated by the Method of Like and Unlike Signs

Tests	1	2	3	4	5	6	7
				Freshmen			
1		+.03	-.19	-.29	+.16	+.19	+.37
2	+.19		+.37	+.28	+.56	+.39	+.19
3	+.28	+.45		+.43	+.25	+.25	-.03
4	+.16	+.54	+.34		+.66	+.48	+.54
5	+.03	+.28	.00	+.06		+.66	+.37
6	+.19	+.31	+.56	+.59	-.03		+.51
7	+.09	-.16	+.40	+.25	-.09	+.22	
				Seniors			

The analogies test shows high correlations with performance in algebra, with general intelligence as estimated by the principal, and by the English teacher. The correlation with performance in language and history is very low.

The cause and effect test shows high correlations with performance in English and with estimated general intelligence.

The memory tests alone show only slight correlations with performance in language and in history, but they do show a significant correlation with estimated general intelligence.

The cancellation test shows practically no correlation with estimated general intelligence, and its correlation with the other tests is low; in some cases, it is negative.

The tests rank as follows in their correlation with general intelligence as estimated by the principal: 1, analogies;

2, cause and effect; 3.5, Dutch Homestead and directions; 5, Marble Statue; 6, word building; 7, cancellation.

The tests rank as follows in their correlation with the pooled rank-order of the 7 tests: 1, cause and effect; 2, directions; 3, analogies; 4, Dutch Homestead; 5, Marble Statue; 6, word building; 7, cancellation.

The pooled rank-order of the 7 tests gives a high correlation with estimated general intelligence and with average performance in all subjects. The correlation is as high as could be expected when one considers the factor, 'persistence of motives,' of which the tests are not a measure.

The analogies test, the cause and effect test or the directions test, used separately, and the combination of all the tests, can be used to advantage to rank students according to their general intelligence.

Mental Tests and Educational Diagnosis

Much has been written on the causes of failures among high-school students. In the literature on this subject practically no emphasis has been placed upon one very important factor, general intelligence. In accord with our democratic ideals we have been inclined to stress the saving power of opportunity, of favorable environmental influences. It is only natural that we should seek the causes of failure in environmental influences and disregard the capability of the individual to profit by these influences. In the absence of any means of determining these capabilities our policy of encouraging everyone to strive to attain the achievement of the most capable has built for us the educational system of which we can all be justly proud.

On the other hand, this policy has resulted in a great waste of energy and in discouragement to those who have been enthusiastic and hopeful in the beginning only to discover later that they are unable to realize their ambitions because of limitations for which they are in no sense responsible.

If mental tests can serve, as I believe they can, as a means to reveal these limitations and to enable educators so to direct the education of students as to prepare them for adult activities in keeping with their ability, the value of such tests cannot be overemphasized.

Studies have been made to show that students who fail in the high school are surrounded outside of the school by environmental influences unfavorable to success. While this is true in many cases, we do know that students with excellent environment also fail to do high-school work successfully. This suggests that there must be a common cause of the failure, independent of the environmental influences. This common cause is lack of ability, lack of general intelligence--a factor which our investigation demonstrates is susceptible of measurement. We do know that the presence of this factor makes success possible even under the most adverse influences. This means that general intelligence <u>creates</u> desirable environment and modifies undesirable environment. Is it not true that we have overlooked the fact that the undesirable environmental influences that surround the students who fail, is in part at least due to the lack of general intelligence of immediate and remote ancestors? This is not an argument for unfavorable environment. While we are in no immediate danger of providing too favorable environment, it may be said that students of ability profit by over-

coming difficulties that challenge their ability. There is little doubt but that some students of moderate ability are overcome by environments that would be quite favorable to their more capable classmates. It is doubtless true, too, that environments do exist that would overpower even the most capable.

The results of an investigation by Miss Jeannette Engle,* not yet published, throws some light on this problem. Miss Engle made a careful survey of the home environment of 24 girls in the Urbana High School, all of whose marks, (or the greater proportion of whose marks) were below 75 per cent and of 26 girls all of whose marks were above 90 per cent. She considered the following points of importance in determining the causes of success or failure of each girl: (a) mentality, (b) character or temperament, (c) environmental conditions influencing the student, (d) the school's articulation with the pupil's needs.

The results of her investigation show the marked contrast between the environments of the two groups. Among the 75 per cent group, however, no single environmental factor was unfavorable in all cases.

As a measure of mentality she used some of the mental tests which the author had given to the girls. It is significant that all of the "75-per cent" girls who had had the tests were below the median in the tests which correlated with general intelligence. Sixty-nine per cent of the "90-per cent" girls who took the tests were above median performance in these tests. Why, we may ask,

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*Jeannette Engle, A Study of School Success and Failure of High-School Girls. Master's Thesis, School of Education, University of Illinois.

were the environmental influences among the 75-per cent girls unfavorable? Why were their parents deficient in education? Since like tends to beget like, it is quite probable that the deficiency in education was due in large part to the same factor that prevents success on the part of their children, namely, a relatively poor degree of general intelligence. To be sure, it is difficult to separate the two factors under discussion. But the important fact remains that in general intelligence the 75-per cent group is below the median, and we have reason to believe, on the basis of heredity, that the parents were also below the median and further that the deficiency of the parents in general intelligence is at least a partial cause of the unfavorable home environment to which the children are exposed.

Reference has already been made to the use of mental tests as a means of classifying students for group instruction on the basis of mental ability. The argument that students of poor ability should associate with their more capable classmates in order to receive stimulation to greater achievement need not receive serious consideration. No one would argue that dwarfs in physical stature should associate with their taller classmates in order to receive the stimulation to grow taller. There are certain activities appropriate to individuals of limited physical powers. Competition with individuals in this group with individuals of decidedly superior physical powers can result only in defeat and discouragement. The same thing is true of individuals of limited mental ability. It is not a question of what they would like to do, but rather of what they <u>can</u> do.

By means of the tests, the principal can secure advance

information with regard to the mental abilities of the student. He can anticipate some of his difficulties--the difficulties that are due to a lack of general intelligence or to a lack of ability in some particular subject. He can then provide special help in advance.

The tests, we believe, will make possible more intelligent educational diagnosis. They will supplement opinion, which has been the chief reliance in this field. The use of the tests must always be accompanied by sane judgment. No educator who appreciates fully the value of the tests will rely wholly upon them. They will serve, however, as a valuable aid to a person possessed of good judgment.

SUMMARY AND CONCLUSIONS

1. The norms established for the seven tests, Cancellation, Dutch Homestead, Marble Statue, Analogies, Cause and Effect, Directions, and Word Building indicate that performance in the tests is conditioned by age, sex, year in the high school, vocation of father, size of family, and the preference of high-school subjects.

2. The difference between the scores of the freshman and sophomore group is small in the tests that correlate highest with general intelligence; but in these same tests the junior and senior group show marked superiority. The seniors as a group make higher scores than do the juniors. The difference is probably due to elimination of the less capable rather than to a development of the abilities tested.

In the tests that show little correlation with general intelligence, cancellation, Dutch Homestead and Marble Statue, there is a gradual increase in efficiency from the freshman to the senior year, with the exception that in the cancellation test the freshmen are better than the sophomores.

3. The differences due to age, independent of year in the high school, are very irregular, that is, there is no regular increase in efficiency with increase in age.

4. In any one year in the high school, the younger students are more efficient. The normal-age students in the two lower years in high school are more efficient than the over-age students in the same years in high school. The fact that the younger

students have made normal progress in the elementary school and the high school is evidence of their superior general intelligence. The retardation of the older students is evidence of their inferior general intelligence as revealed by the tests. It is among the older students that elimination is greatest.

4. The sex differences are not great. In the tests that show a high positive correlation with general intelligence, analogies and cause and effect, the boys do slightly better than the girls. In all of the other tests the girls are superior to the boys.

5. The correlation of general intelligence as measured by the tests and school performance reveals the fact that the superior industry and docility of the girls is in part responsible for their better performance in high-school subjects as measured by the marks which they receive. Sex difference in intelligence is not great enough to account for the better marks.

6. The superiority of children of the professional class over the children of other classes in the tests that show high positive correlation with general intelligence indicates that heredity is a factor in determining the performance of high-school students.

This difference is probably greater than the tests indicate, since family tradition for high-school education in the professional class and economic conditions in the other classes act as selective agencies in lowering the score of the children of the former group and in raising the score of the children of the latter group.

The superiority of the children of skilled laborers in

the cancellation test, which shows no correlation with general intelligence points to the same conclusion mentioned above. It should be pointed out here that the skilled labor class, considered in this investigation, was not composed of highly skilled laborers. The results obtained from children of highly skilled laborers would probably reveal a higher degree of general intelligence.

7. The higher score of children of fathers who had more than an elementary education suggests again the influence of heredity.

8. The relation between preference for mathematics and performance in the analogies test, which shows a high positive correlation with marks in algebra, warrants the conclusion that the possession of the ability demanded in mathematics is commonly accompanied by preference for that subject; and that a lack of this same ability is a factor in determining the dislike for, and failure in, mathematics.

9. There is a wide range in the performance of students in each of the tests. The range is least in the cancellation test (1:3.7), and greatest in the directions test (1:9.27). The range of performance is greatest in the tests that show high positive correlation with general intelligence.

This wide range in performance sets a serious problem in connection with group instruction, the solution of which would be simplified by classifying the students on the basis of ability as measured by the tests.

Taking the average score in the analogies test as a standard rate for perceiving very simple relations, we have reasons to believe that most freshmen high-school recitations proceed at a rate adapted to the best 10 in 100 students.

10. All of the tests except the cancellation show significant positive correlation with general intelligence as indicated by school marks and by estimates of teachers and the principal. The tests rank as follows in their correlation with the principal's estimate of general intelligence: 1. Analogies; 2, Cause and Effect; 3.5, Directions; 3.5, Dutch Homestead; 5, Marble Statue; 6, Word Building; 7, Cancellation.

11. In order of their correlation with the pooled rank-order of all the tests they rank as follows: 2, Directions; 4, Dutch Homestead; 3, Analogies; 5, Marble Statue; 1, Cause and Effect; 6, Word Building; 7, Cancellation.

12. The correlation of the analogies test with mathematical ability is high enough to warrant the use of the analogies test as a safe basis for the classification of students in mathematics.

13. The Cause and Effect test could serve the same purpose among students of English.

14. The memory tests do not show the significant correlation with school marks in language and history that was expected.

15. The pooled rank-order of all the tests shows a high correlation with average school performance and with estimated general intelligence by teachers and by the principal.

16. By means of the analogies test alone one is able through an acquaintance of 15 minutes to rank students on the basis of general intelligence as effectively, if not more effectively, than a teacher or principal through an acquaintance of one semester.

17. Correlations between the tests and school perform-

ance would be much higher were it not that marks are not determined by general intelligence alone. Industry, a factor which the tests do not measure, is instrumental in modifying decidedly the school performance of the student of average general intelligence.

18. With adequate norms established, mental tests furnish a means whereby with little time and effort the high-school principal can secure in advance information concerning his students, that will render his advice much more intelligent, and that will enable him to anticipate difficulties, and modify instruction so as to avoid them.

The author predicts that the time will come when mental examination of high-school pupils will be as common as physical examination. Why should this not come to pass? If a boy is to participate in athletics, it is important to know the condition of his heart, lungs and muscles; the physical examination record makes this knowledge available. If a boy is to pursue a course in mathematics, it is just as important to know something of his ability to perceive logical relations, his general intelligence. This information and more, just as easily obtained, should be available in the mental examination record.

TABLE I

Showing the number and age of each of 113 high-school freshmen, with the score in each test taken and the decile in which it falls. In the case of tests 4 and 5 the median of the twenty responses is given

Number	Age	Test 1		Test 2		Test 3		Test 4			Test 5			Test 6		Test 7	
		Score	Decile	Score	Decile	Score	Decile	Score	Median	Decile	Score	Median	Decile	Score	Decile	Score	Decile
1	16	.798	10	46	8	42	7	260.5	7.5	6	418	24	1	.391	3	21	2
2	16	.606	5	50	9	44	8	372.4	22	2	182.4	4.5	6	.608	8	27	4
3	16.5	.384	1	30	4	38	5	278.5	8.5	6	198.1	5	5			34	8
4	14.5	.593	4	42	7	40	7	190.1	6.7	9	200	7	3	.563	6	30	6
5	15	.731	9	18	1	32	3	309.5	12.1	4	294.9	9	2			32	7
6	16	.664	6	13	1	39	6	306.9	12.7	4	405.5	30	1	.74	9	31	6
7	15	.572	3	30	4	43	8	159.8	5.1	10	101.1	4	10			36	8
8	15.5	.725	9	27	3	39	6	337.	11.0	2	287.6	13	2	.448	5	38	9
9	16	.676	7					407.2	26	1	283.8	10.1	3	.295	2	22	2
10	15	.818	10	53	10	31	2	231.2	7.3	7	135.1	3.2	8	.726	9	41	10
11	15	.595	4	41	7	50	10	185.1	5.0	9	154.6	4.1	7	.777	9	40	9
12	16	.639	5											.541	6	29	5
13	17	.677	7	31	4	28	2	477.8	30	1	308.5	8.1	1	.286	1	29	5
14	18.5	.581	3	29	3	35	4	548.1	30	1	351.4	13.2	1	.200	1	27	4
15	16.5	.731	9	31	4	45	9	252.8	7.0	6	190.1	4.2	6	.60	8	26	4
16	16	.535	2	26	2	55	10	90.8	3.7	10	133.7	3.1	8	.613	8	44	10
17	14.5	.40	1	17	1	31	2	341.2	12	2	308.4	12.4	2	.288	1	21	2
18	18	.64	5	53	10	47	10	204.5	4.0	8	95.8	3	10	.865	10	34	8
19	15	.598	4	49	9	44	8	188	5.0	9	161.1	3.5	7	.338	2	32	7
20	15.5	.624	5	10	1	32	3	284	8.1	5	308.4	13.6	2	.515	6	13	1
21	15.5	.702	8	43	7	41	7	306.6	11.4	4	223.5	6.6	4	.417	4	28	4
22	16.5	.671	7	45	8	44	8	84.9	3.0	10	117.8	4.2	9	.78	9	30	6

TABLE I, (continued)

Number	Age	Test 1 Score	Test 1 Decile	Test 2 Score	Test 2 Decile	Test 3 Score	Test 3 Decile	Test 4 Score	Test 4 Median	Test 4 Decile	Test 5 Score	Test 5 Median	Test 5 Decile	Test 6 Score	Test 6 Decile	Test 7 Score	Test 7 Decile
23	14.5	.99	10	46	8	39	6	300.8	14.1	4	243.3	5.2	3	.494	5	18	1
24	15.5	.792	10	63	10	36	4	293.4	15.7	5	194.6	6.2	6			38	9
25	16.5	.718	8	24	2	46	9	222		6.0	7	202.6	5.2	5	.417	4	19	1
26	15	.492	2	22	2	27	2	301.7	12		4	369.1	19.3	1	.405	3	19	1
27	16.5	.679	7	51	9	45	9	181.1		4.5	9	219.6	6.5	4	.549	6	33	7
28	14.5	.523	2					285.5		8.8	5	313.2	10.1	1	.286	1	23	2
29	16	.637	5	14	1	32	3	292.1	12		5	281.1	11.1	3	.389	3	37	8
30	15.5	.423	1	65	10	49	10	171.3		4.2	9	60.2	2.0	10	.752	9	34	8
31	16	.651	6	25	2	40	7	326.4	12.6		3	237.7	6.1	4	.607	8	26	4
32	14.5	.80	10	26	2	43	8	218.6		4.8	8	128.5	3.5	9	.60	8	32	7
33	16.5	.68	7	34	6	36	4	227		6.0	7	105.6	2.7	10			44	10
34	16.5	.733	9	37	6	35	4	306		9.6	4	132.1	4.7	9	.634	8	18	1
35	16.5	.618	5	46	8	20	1	186.7		4.8	9	64.5	2.4	10	.922	10	39	9
36	15	.505	2	34	6	45	9	356.3	15.9		2	144.2	6.1	8	.262	1	20	2
37	15.5	.712	8	43	7	41	7	323.3	15.2		3	199.9	4.1	5	.506	6	32	7
38	17.5	.681	7	60	10	42	7	398.3	27.1		1	183.4	4.6	6	.524	6	32	7
39	13.5	.518	2	33	5	43	8	220.3		5.4	7	209.4	7.7	5	.475	5	36	8
40	17.5	.539	3	49	9	43	8								.426	4	26	4
41	16	.90	10	53	10	45	9	241.6		4.9	7	223.8	7.7	4	.566	7	34	8
42	16	.660	6	51	9	44	8	322.6	15.1		3	144.6	3.0	8	.60	8	32	7
43	14	.478	1	33	5	44	8	159.2		3.6	10	65	2.8	10	.55	6	29	5
44	16	.754	9	21	2	33	3	254.3		8.6	6	92.9	3.9	10	.90	10	32	7
45	16	.494	2	34	6	25	1								.47	5	20	2
46	14	.657	6	48	8	43	8	214.8		6.7	8	172	5.8	7	.408	3	26	4
47	16	.737	9	55	10	39	6	226.9		5.7	7	172.6	3.5	7			26	4
48	15.5	.70	8	29	3	37	5								.352	2	26	4
49	16	.594	4	30	4	32	3	211.9		4.8	8	157.2	4.0	8	.476	5	30	6
50	18.5	.647	6	11	1	20	1											
51	15	.728	9	44	7	40	7								.435	4	44	10

TABLE I (continued)

Number	Age	Test 1 Score	Test 1 Decile	Test 2 Score	Test 2 Decile	Test 3 Score	Test 3 Decile	Test 4 Score	Test 4 Median	Test 4 Decile	Test 5 Score	Test 5 Median	Test 5 Decile	Test 6 Score	Test 6 Decile	Test 7 Score	Test 7 Decile
52	15.5	.696	8	20	1	34	3	417.7	25.1	1	279.6	11.1	3	.290	2	27	4
53	15.5	1.02	10	18	1	36	4							.931	10	40	9
54	16	.513	2											.526	6	20	2
55	18	.644	5	30	4	31	2							.335	2		
56	15	.535	2	21	2	39	6							.447	4	25	3
57	16.5	.74	9	29	3	35	4							.704	8	30	6
58	15.5	.60	4	43	7	37	5							.60	8	32	7
59	15	.588	4	41	7	39	6									27	4
60	16	.586	4	22	2	42	7							.463	5	25	3
61	14.5	.562	3	44	7	37	5							.552	6	18	1
62	15	.648	6	35	6	40	7							.72	9	34	8
63	14.5	.692	7	49	9	46	9							.578	7	41	10
64	15	.581	3	21	2	50	10							.503	6	24	3
65	15.5	.69	7	48	8	25	1							.317	2	22	2
66	16.5	.657	6	36	6	39	6							.436	4	28	4
67	15.5	.511	2	35	6	40	7							.443	4	30	6
68	15.5	.685	7	43	7	30	2							.275	1		
69	16	.492	2	31	4	45	9							.450	5	29	5
70	15	.492	2	45	8	45	9							.376	3	28	4
71	16	.547	3	54	10	39	6							.383	3	56	10
72	15	.645	5	32	5	49	10							.40	3	46	10
73	17.5	.601	4	51	9	37	5							.423	4	15	1
74	14	.683	7	28	3	48	10							1.00	10	34	8
75	20	.557	3											.415	4	31	6
76	15.5	.486	1	36	6	40	7							.741	9	26	4
77	16	.62	5	36	6	25	1							.825	10	42	10
78	15.5	.537	2	35	6	41	7							.60	8	33	7

TABLE I (continued)

Number	Age	Test 1 Score	Test 1 Decile	Test 2 Score	Test 2 Decile	Test 3 Score	Test 3 Decile	Test 4 Score	Test 4 Median	Test 4 Decile	Test 5 Score	Test 5 Median	Test 5 Decile	Test 6 Score	Test 6 Decile	Test 7 Score	Test 7 Decile
79:	14.5	.288	1	41	7	40	7							.621	8	32	7
80:	15.5	.704	8	39	6	36	4							.567	7	31	6
81:	14.5	.724	9	29	3	36	4							.160	1	35	8
82:	14.5	.76	9	30	4	40	7							1.188	10	39	9
83:	15.5	.723	8	28	3	38	5							.760	9	43	10
84:	14.5	.571	3	33	5	47	10							.486	5	27	4
85:	15.5	.714	8	31	4	24	1							.27	1	26	4
86:	16	.619	5	30	4	27	2							.25	1	13	1
87:	16	.49	1	57	10	37	5							.655	8	16	1
88:	19	.588	4	16	1	19	1									17	1
89:	15.5	.655	6	48	8	40	7							.72	9	24	3
90:	17	.707	8	32	5	31	2							.50	5	39	9
91:	14	.446	1	18	1	39	6							.377	3	20	2
92:	15.5	.754	9	53	10	47	10							1.034	10	45	10
93:	13.5	.714	8	28	3	45	9							.633	8	31	6
94:	18	.811	10	36	6	30	2									38	9
95:	16.5	.551	3											.472	5	38	9
96:	15.5	.596	4	59	10	47	10							.82	10	33	7
97:	16	.811	10	28	3	33	3									37	8
98:	17	.565	3	51	9	40	7							.625	8	29	5
99:	15	.441	1	16	1	38	5							.262	1	29	5
100:	16.5	.651	6	39	6	27	2							.349	2	33	7
101:	15	.66	6	60	10	34	3							.579	7	34	8
102:	16.5	.674	7	23	2	27	2							.359	2	40	9
103:	13.8	.648	6	51	9	35	4							.60	8	38	9
104:	20.5	.522	2	49	9	47	10							.419	4	23	2
105:	14	.80	10	34	6	27	2							.309	2	30	6

TABLE I (continued)

Number	Age	Test 1 Score	Test 1 Decile	Test 2 Score	Test 2 Decile	Test 3 Score	Test 3 Decile	Test 4 Score	Test 4 Median	Test 4 Decile	Test 5 Score	Test 5 Median	Test 5 Decile	Test 6 Score	Test 6 Decile	Test Score	Test Decile
79'	14.5			28	3	36	4	283.7	7.7	5	252.8	10.8	3				
a				46	8	41	7										
b				32	5	48	10										
c				32	5	35	4										
d				30	4	18	1										
21'	15							363.4	18	2	188.1	4.2	6				
90'	17.5							375.6	15.6	2	303.8	11.4	2				
67'	15							328.	14.2	3	215.6	5.4	4				

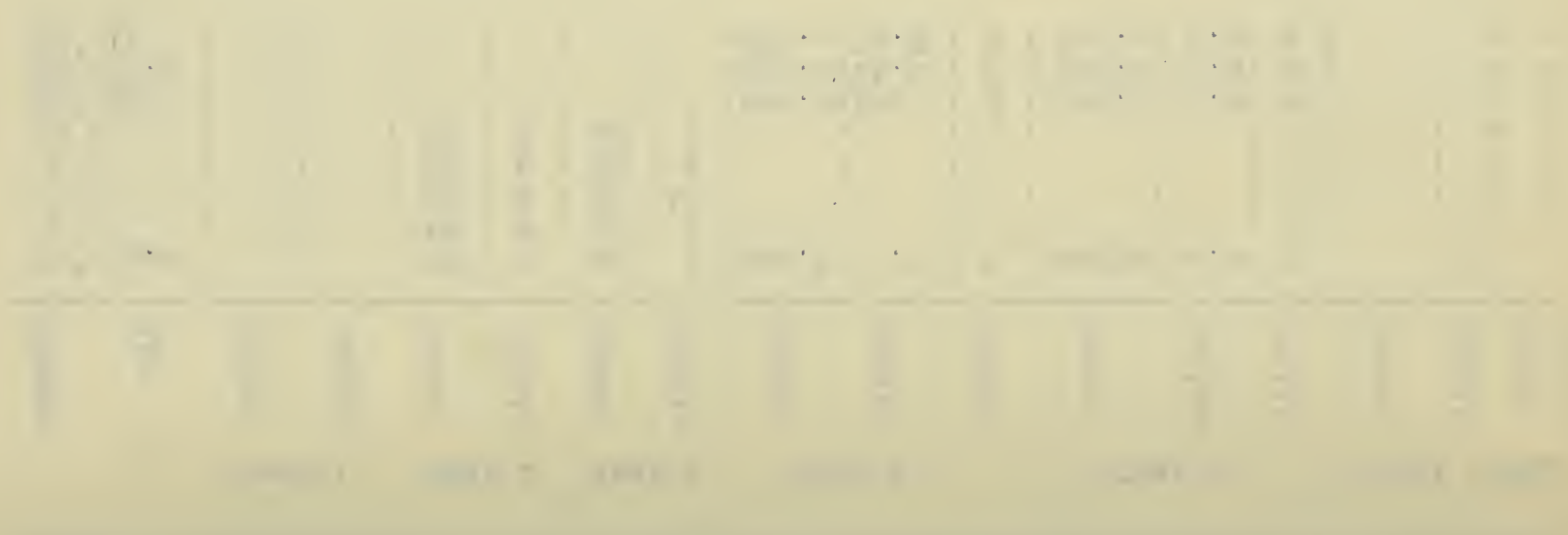

TABLE II

Showing the number and age of each of 110 high-school sophomores with the score in each test taken and the decile in which it falls. In the case of tests 4 and 5 the median of the twenty responses is given

Number	Age	Test 1		Test 2		Test 3		Test 4			Test 5			Test 6		Test 7	
		Score	Decile	Score	Decile	Score	Decile	Score	Median	Decile	Score	Median	Decile	Score	Decile	Score	Decile
106	17	.669	7	31	3	39	5	445.2	30	1	210	8.0	5	.428	3	30	4
107	18	.576	4	39	5	40	6	282.3	9.7	5	346.5	15.8	1			33	6
108	16.5	.546	3					133.6	4.1	10	100.5	3.4	9	1.188	10	35	7
109	18	.604	5	21	1	46	9	319.1	11.5	3	372.4	20	1	.441	4	33	6
110	16.5	.576	4	25	2	36	4	414.4	30	1	400.3	22.5	1	.666	9	41	9
111	16.5	.666	7					194.7	6.2	8	100.8	3.0	9	.444	4	27	2
112	17.5	.655	7	41	6	40	6	379.4	14.5	2	304.1	9.0	2			40	9
113	16	.731	9	40	5	40	6	252.6	6.2	6	106.2	4.0	9	.430	4	31	5
114	17	.542	3	49	8	38	5	151.7	4.05	9	229.5	6.5	4	.50	5	29	3
115	17.5	.666	7	42	6	37	4	142.1	3.65	9	165.3	4.1	7	.666	9	29	3
116	16.5	.49	1	47	8	35	3	431.2	30	1	245.4	7.5	3			12	1
117	16	.785	10	33	3	46	9	268.8	8.7	5	220.4	3.1	4	.736	9	37	8
118	15.5	.619	5					206.4	5.7	8	130.5	4.1	9	.559	6	23	2
119	16	.741	9	29	3	42	7	204.5	6.2	7	268.3	10.7	2	.447	4	24	2
120	16	.452	1	22	1	37	4	319.8	9.8	3	377.4	20.1	1	.30	1	20	1
121	17.5	.48	1					261.7	7.2	6	215.1	5.0	4			18	1
122	18.5	.571	4	16	1	30	2	397.5	28.5	2	395.5	20	1	.419	3	26	2
123	17.5	.561	4	34	4	38	5	350.1	24.	3	325.6	10.9	1	.326	2	32	5
124	15	.533	2	27	2	41	6	271.7	10.8	5	198.5	6.2	5			36	7
125	17.5	.714	8	37	5	31	2	258.2	6.8	6	91.8	2.7	10	.667	9	30	4
126	16.5	.454	1	54	9	37	4	191.9	4.2	9	166.7	3.5	6	.341	2	41	9
127	15.5	.657	7	65	10	44	8	197.6	4.6	8	265	11.2	2	.616	8	38	8

TABLE II (continued)

Number	Age	Test 1 Score	Test 1 Decile	Test 2 Score	Test 2 Decile	Test 3 Score	Test 3 Decile	Test 4 Score	Test 4 Median	Test 4 Decile	Test 5 Score	Test 5 Median	Test 5 Decile	Test 6 Score	Test 6 Decile	Test 7 Score	Test 7 Decile
128	16.5	.604	5	47	8	43	7	242.1	7.3	7	143.5	5.0	7	.525	6	29	3
129	15	.573	4	65	10	46	9	194.5	5.3	8	101.9	4.2	9	.746	9	26	2
130	16.5	.80	10	36	4	28	1	288.3	9.5	4	229.2	7.0	4	.387	2	31	5
131	15.5	.565	4	60	10	49	10	217.2	4.9	7	84.2	2.9	10	.746	9	34	6
132	14.5	.596	5	54	9	45	9							.817	10	32	5
133	16.5	.739	9	43	7	34	3	401	20.5	8	214	7.3	5	.300	1	15	1
134	17	.724	9	58	9	42	7	293.5	11.7	4	104.7	5.4	9	.577	7	28	3
135	16	.758	9	28	2	39	5	409.6	30	1	250.5	9.0	3	.361	2	26	2
136	18	.481	1	53	9	43	7	297	15.2	4	184.2	6.4	6	.655	8	44	10
137	17	.541	3	59	9	44	8							.524	6		
138	19	.570	4	35	4	30	2	263.6	9.8	6	181.8	5.8	6	.268	1	35	7
139	15.5	.425	1	50	8	41	6							.687	9	40	9
140	15.5	.532	2	32	3	44	8	166	5.5	9	145	4.7	7	.870	10	40	9
141	16.5	.530	2	39	5	34	3							.597	7	28	3
142	18.5	.693	8	31	3	31	2	332.8	13.8	3	191.1	6.5	6	.303	1	30	4
143	15.5	.583	5	35	4	39	5	105.5	4.0	10	133.3	4.6	8	.578	7	38	8
144	15.5	.676	7	53	9	45	9	265.2	9.6	5	233.9	9.2	4	.666	9	41	9
145	16	.571	4	53	9	34	3	179.1	5.4	9	214	6.0	5	.424	3	32	5
146	16.5	.636	6					373.6	24.9	2	150.9	5.4	7	.257	1	30	4
147	16	.786	10	57	9	48	10	204.1	6.0	7	116.2	3.0	9	.792	10		
148	16	.782	10	36	4	45	9	439.3	30	1	199.4	5.6	5	.552	6	21	1
149	16	.541	3	69	10	49	10	152	4.0	9	119.7	2.9	9	1.188	10	40	9
150	16.5	.643	7	25	2	27	1	226.5	4.2	7	142.5	3.7	7	.508	5	36	7
151	18.5	.527	2	34	4	23	1	446.3	30	1	256.8	10	3	.181	1		
152	15	.658	7	56	9	43	7							.556	6	35	7
153	16	.697	8	43	7	27	1	140.7	4.6	10	74	3.0	10	.765	9	46	10
154	16	.774	9	43	7	23	1							.559	7	40	9
155	16	.705	8	21	1	34	3	436.8	30	1	318.7	13.4	2	.577	7	26	2

TABLE II (continued)

Number	Age	Test 1		Test 2		Test 3		Test 4			Test 5			Test 6		Test 7	
		Score	Decile	Score	Decile	Score	Decile	Score	Median	Decile	Score	Median	Decile	Score	Decile	Score	Decile
156	16.5	.718	9	35	4	36	4							.613	8	31	5
157	17	.584	5	53	9	46	7	119.4	3.2	10	68.1	2.8	10	.562	7	41	9
158	16.5	.634	6											.50	5	40	9
159	17	.693	8	38	5	39	5	358.6	23.5	3	264.6	10.9	2	.432	4		
160	19	.552	3	47	8	42	7	251.3	5.7	6	191.3	5.4	6	.500	5	32	5
161	15.5	.686	8	47	8	41	6							.516	5	41	9
162	19.5	.639	6	62	10	42	7	305.6	8.1	4	156.4	4.1	7	.409	3		
163	13.5	.676	7											.486	5	31	5
164	18	.550	3	31	3	45	9	360.4	20.4	3	233.6	10.2	4	.375	2	32	5
165	17.5	.650	7	43	7	46	9							.267	1	34	6
166	15.5	.60	5	43	7	38	5	199	3.6	8	65.3	1.8	10	1.056	10	35	7
167	17	.741	9	48	8	46	9	217.4	5.3	7	119.9	4.1	9	.359	2	38	8
168	16	.543	3	36	4	34	3							.688	9	50	10
169	17.5	.690	8	18	1	30	2									24	1
170	16.5	.404	1	43	7	39	5									23	2
171	16.5	.600	5	42	6	38	5							.75	9	37	8
172	16.5	.607	5	52	8	48	10							.446	4	37	8
173	18	.579	4	41	6	44	8							.574	7	30	4
174	17	.701	8	29	3	52	10									43	10
175	18	.804	10	42	6	42	7							.423	3	36	7
176	18.5	.341	1											.474	5	35	7
177	14.5	.524	2	60	10	50	10							.629	8	31	5
178	17.5	.446	1	62	10	44	8									44	10
179	16.5	.510	2	52	8	44	8							.644	8	36	7
180	15.5	.635	6	46	7	40	6							.581	7	40	9
181	15	.629	6	24	1	43	7							.826	10	44	10
182	16	.714	8	42	6	48	10							.463	5	30	4
183	15.5	.413	1	25	1	32	1							.322	2	28	3

TABLE II (continued)

Number	Age	Test 1 Score	Test 1 Decile	Test 2 Score	Test 2 Decile	Test 3 Score	Test 3 Decile	Test 4 Score	Test 4 Median	Test 4 Decile	Test 5 Score	Test 5 Median	Test 5 Decile	Test 6 Score	Test 6 Decile	Test 7 Score	Test 7 Decile
184	17.5	.600	5	28	2	29	1							.277	1	10	1
185	16.5	.561	4	47	8	38	5							.556	6	25	2
186	16	.864	10	37	5	36	4									32	5
187	17.5	.943	10	46	7	46	9							.559	7	37	8
188	17.5	.746	9	31	3	26	1							.446	4	35	7
189	19.5	.550	3	37	5	33	1							.380	2	36	7
190	18.5	.669	7	21	1	32	2									29	3
191	17.2	.533	2	37	5	26	1							.429	3	30	4
192	16.5	.618	6	43	7	48	10									41	9
193	15	.600	4	43	7	44	8							.544	6	40	9
194	17	.500	3	49	8	44	8							.413	3	42	10
195	15	.538	3	35	4	35	3									36	7
196	16	.571	4	31	3	39	5							.667	9	35	7
197	18	.873	10													18	1
198	16	.629	6	28	2	32	2							.447	4	30	4
199	16	.754	9	26	2	33	2							.398	3	22	1
200	17.5	.924	10	41	6	35	3							.319	1	20	1
201	15.5	.689	8	51	8	42	7							.443	4	28	3
202	16	.538	3	36	4	38	5							.667	9	35	7
203	16	.617	6	64	10	48	10							.849	10	50	10
204	17	.359	1	24	1	43	7							.546	6	35	7
205	16	.512	2	58	9	46	9							.38	2	41	9
206	18.5	.639	6	56	9	41	6							.559	7	43	10
207	16	.621	6	21	1	52	10									32	5
208	20.5	.832	10	68	10	40	6									31	5
155'	17			47	8	49	10	288	11.0	5	239.8	6.4	3				
a				40	5	38	5										
b				39	5	36	4										
c				67	10	49	10										
d				15	1	17	1										
e				26	1	39	5										
f				49	8	35	3										

TABLE III

Showing the number and age of each of 96 high-school juniors, with the score in each test and the decile in which it falls. In the case of tests 4 and 5 the median of the 20 responses is given

Number	Age	Test 1		Test 2		Test 3		Test 4			Test 5			Test 6		Test 7	
		Score	Decile	Score	Decile	Score	Decile	Score	Median	Decile	Score	Median	Decile	Score	Decile	Score	Decile
209	21	.503	2	24	1	35	2	250.7	8.7	4	132.6	5.2	7	.864	9	35	4
210	16.5	.583	3	27	2	36	3	219.1	9.0	6	90.9	3.2	9	.780	8	41	7
211	17	.819	9	21	1	40	5	210	6.2	7	161.5	4.2	4	.756	8	33	4
212	18	.655	5	42	5	41	6	180.7	7.1	8	156.1	4.5	5	.545	5	27	1
213	17	.806	9	44	5	42	6	229.9	5.4	6	155.5	4.9	5	.731	7	46	9
214	17.5	.693	6					332.2	14.5	2	291.9	7.6	1	.760	8	32	3
215	19	.739	8	33	3	44	8	166.8	5.0	9	253.8	11.2	1	.793	8	42	8
216	18	.648	4											.666	6	46	9
217	15	.810	9	45	6	48	9	172.4	4.05	9	91.2	3.1	9	.957	10	53	10
218	17	.572	3	27	2	44	8	165.2	5.1	9	167.1	4.5	4	.88	9	34	4
219	16.5	.442	1	33	3	36	3	325.9	15.1	3	237.8	8.0	2	.464	3	30	2
220	17	.605	3					203.2	6.1	7	144.3	3.5	6	1.06	10	30	2
221	17	.707	7	48	7	40	5	190.3	5.9	7	139.8	4.3	7	.864	9	52	10
222	16.5	.686	6	65	10	58	10	240	8.0	5	217	5.7	2	.518	4	37	5
223	18	.614	4	73	10	57	10							.752	7	31	3
224	18	.609	3					254	8.0	4	238	9.7	2	.613	6	53	10
225	17.5	.673	5	53	8	44	8	257.6	7.0	4	71.6	3.3	9	1.059	10	31	3
226	17.5	.887	10	54	8	36	3	210.9	5.1	7	213	6.2	3	.62	6	47	10
227	16	.713	7	56	9	46	9	366	22.5	1	284.3	8.3	1	.714	7	43	8
228	16	.683	6	29	2	33	2	190.1	3.8	7	62.8	2.5	10	.813	8	39	6
229	17	.92	10	37	4	31	2	234	9.1	5	182.7	4.3	3			46	9
230	18.5	.898	10	47	6	33	2	280	5.2	3	66	3.0	10	.92	9	42	8
231	16.5	.713	7					220	4.8	6	157.3	6.2	5			32	3
232	17.5	.538	3					189.6	3.8	9	119.3	3.4	9	.586	7	39	8

TABLE III (continued)

Number	Age	Test 1 Score	Test 1 Decile	Test 2 Score	Test 2 Decile	Test 3 Score	Test 3 Decile	Test 4 Score	Test 4 Median	Test 4 Decile	Test 5 Score	Test 5 Median	Test 5 Decile	Test 6 Score	Test 6 Decile	Test7 Score	Test7 Decile
232.5	16.5	.585	1					338.9	13.9	1	146	5.5	4	.616	4	39	6
233	16.5	.826	10	26	1	37	4	269.2	12.7	3	184.3	4.4	3	.934	10	37	5
234	17.5	.45	1	80	10	46	9	84.3	3.6	10	52.4	1.8	10	.615	6	34	4
235	17	.802	9	46	6	42	6	347.4	15.7	2	147.7	3.9	6	.536	4	29	2
236	18	.545	2	31	2	28	1	280.5	8.4	3	141	4.0	6	.183	1		
237	17.5	.521	2	23	1	45	8							.576	5	27	1
238	16.5	.803	9	39	4	30	1	266.7	8.2	4	113.4	3.4	8	.38	2	42	8
239	17	.524	2	42	5	40	5	253	6.8	4	180.7	3.4	4			30	2
240	18.5	.462	1	32	3	41	6	234	6.7	5	124.6	4.8	7			32	3
241	17	.702	6	49	7	31	2	169	3.1	9	135	4.0	7	.709	7	45	9
242	17.5	.952	10	48	7	38	4	169.1	3.1	9	286.6	6.0	1	.720	7	40	7
243	18	.592	3	14	1	14	1							.65	6	30	2
244	17	.802	9	60	9	44	8	410.5	11.0	1	152.6	3.9	6	.629	6	46	9
245	17	.650	4	44	5	31	2	280.7	9.9	3	123.8	5.4	8	.531	4	36	5
246	18.5	.775	8											.414	3	33	4
247	16.5	.702	6	54	8	43	7							.465	3	52	10
248	17	.415	1	56	9	40	5	197.7	6.1	7	116.6	5.4	8			39	6
249	18	.77	8	37	4	41	6	328.6	13.8	2	248.7	7.7	1	.709	7	38	6
250	17	.875	10	51	7	48	9	269.4	6.7	3	180.2	4.5	4	.455	3	34	4
251	17.5	.635	4	42	5	40	5							.882	9	38	6
252	15.2	.817	9	53	8	47	9	132.3	3.9	10	82.6	2.7	9			50	10
253	17	.485	1	58	9	43	7							.407	2	37	5
254	17													.472	3	45	9
255	16.5	.642	4	35	3	51	10	328.2	11.5	2	132.4	3.1	7	.721	7	39	6
256	17.5	.664	5	63	9	36	3									28	1
257	18	.693	6	33	3	38	4	172.9	4.9	9	172.9	6.5	4	.407	2	45	9
258	18.5	.756	8	56	9	41	6	302.6	9.9	3	183.9	5.0	3	.346	1	41	7
259	18	.633	4	44	5	46	9	181.6	5.0	8	68.8	2.4	10	.826	9	41	7
260	16.5	.825	9	46	6	37	4	223.9	7.6	6	233.9	7.5	2	.794	8	41	7

TABLE III (continued)

Number	Age	Test 1		Test 2		Test 3		Test 4			Test 5			Test 6		Test 7	
		Score	Decile	Score	Decile	Score	Decile	Score	Median	Decile	Score	Median	Decile	Score	Decile	Score	Decile
261	17	.709	7					391.7	23.	1	213.9	8.1	3	.359	1	32	3
262	17.5	.727	8	52	8	46	9									31	3
263	17	.673	5														
264	16.5	.673	5	37	4	41	6							.576	5	36	5
265	18	.65	4											.294	1	42	8
266	18			27	2	29	1							.567	5	41	7
267	21	.666	5	24	1	25	1							.375	2		
268	18	.557	2	39	4	37	4									29	2
269	19.5	1.00	10													45	9
270	17	.427	1	44	5	51	10							.470	3	58	10
271	16	.492	2	58	9	50	10							.556	5	42	8
272	17	.705	7	46	6	43	7							.552	5	40	7
273	16.5	.413	1											.292	1	29	2
274	15.5	.666	5	46	6	38	4							.779	8	42	8
275	17	.572	3	28	2	47	9							.25	1	33	4
276	19.5	.581	3	50	7	42	6							.250	1	26	1
277	19	.60	3											.478	4	40	7
278	18	.772	8	38	4	25	1							.60	6	29	2
279	20.5	.687	6	64	10	52	10							.818	9	53	10
280	18.5	.66	5	59	9	43	7							1.484	10	51	10
281	16.5	.495	2	64	10	45	8									41	7
282	17	.629	4	50	7	39	5							1.09	10	44	8
283	19	.688	6											.407	2	30	2
284	17.5	.635	4	31	2	34	2							.438	3	37	5
285	17	.717	7	47	6	38	4							.935	10	34	4
286	17.5	.924	10											.517	4	30	2
287	17.5	.725	7	66	10	48	9							.515	4		
288	18	.733	8											.229	1	32	3
289	17	.797	9	49	7	49	10							.401	2	46	9
290	17.5	.451	1	40	4	37	4							.519	4	38	6

TABLE III (continued)

Number	Age	Test 1		Test 2		Test 3		Test 4			Test 5			Test 6		Test 7	
		Score	Decile	Score	Decile	Score	Decile	Score	Median	Decile	Score	Median	Decile	Score	Decile	Score	Decile
291	17.5	.71	7	39	4	33	2							.366	2	18	1
119'	17							217.7	8.1	6	155.3	3.7	5				
174'	14			72	10	44	8	111.6	3.2	10	96.7	3.4	8				
180'	16.5			30	2	39	5	176.5	6.2	8	200.7	6.7	3				
187'	17.5							349	16.6	1	112.8	3.4	8				
191'	17.5							417.6	21.9	1	96.2	3.4	8				
205'	17			51	7	49	10	242.4	8.1	4	159.6	7.6	5				
a	19							440.7	30	1	271.4	10	1				
b				48	7	35	2										
c				53	8	41	6										
d				17	1	38	4										
e				38	4	36	3										
f				40	4	44	8										

TABLE IV

Showing the number and age of each of 94 high-school seniors with the score in each test taken and the decile in which it falls. In the case of tests 4 and 5 the median of the 20 responses is given

Number	Age	Test 1		Test 2		Test 3		Test 4			Test 5			Test 6		Test 7	
		Score	Decile	Score	Decile	Score	Decile	Score	Median	Decile	Score	Median	Decile	Score	Decile	Score	Decile
292	17	.633	3	51	6	46	8	195.5	4.0	6	167.5	4.0	3	.613	4	40	6
293	18	.641	4	40	3	46	8	219.5	5.2	4	177.5	4.0	2	1.013	10	45	8
294	20.5	.709	6	68	9	45	7	144.8	5.6	9	122.3	4.5	5	.752	7	44	8
295	19.5	.603	2	23	1	28	1	418	28.5	1	104.9	4.2	6	.584	3	22	1
296	18	.772	7	76	10	48	9	168.2	4.3	7	164.3	5.9	3	.83	8	51	10
297	17.5	.913	10	61	8	49	9	153.9	5.0	9	134.7	4.5	5	.826	8	60	10
298	17.5	.664	4	69	10	53	10	129.5	4.0	9	119	3.0	6	1.089	10	47	8
299	19.5	.620	3	70	10			96.1	3.0	10	74.7	3.0	10	.590	4	46	8
300	17.5	.706	6	71	10	55	10	135	3.5	9	117	4.2	6	1.017	10	37	4
301	18.5	.770	7	70	10	42	6	155.4	5.5	8	154.5	4.5	3	.805	8	53	10
302	17.5	.826	9	61	8	49	9	70.6	2.1	10	84.8	2.5	8	1.234	10	52	10
303	17.5	.480	1	62	9	45	7							.588	4	28	2
304	19	.774	8	22	1	42	6	208.9	3.5	5	145.9	4.5	4	.63	4	39	6
305	17.5	.824	9	58	7	48	9	225.7	5.6	4	99	3.6	7	.566	3	48	9
306	20	.593	2	36	3	27	1	286.5	10	2	291.2	10.6	1	.594	3		
307	17.5	.767	7	33	2	44	7	86.8	3.6	10	117.3	4.4	6	.726	6	51	10
308	19	.758	7	25	1	30	1										
309	19.5	.530	1	60	8	34	2	272.5	8.2	2	225.4	5.8	1	.559	3	43	7
310	19.5	.686	5					198.1	9.1	6	83.7	2.5	9			49	9
311	19.5	.704	6					419.9	30	1	269.3	9.4	1	.50	2	38	5
312	18.5	1.066	10	50	6	33	1	193.7	4.4	6	153.7	4.9	4	.667	5	38	5
313	21.5	.660	4	47	5	45	7							.462	2	43	7
314	18.5	.758	7	50	6	47	8	208.4	6.1	5	102.2	4.0	7	.757	7	24	1

TABLE IV (continued)

Number	Age	Test 1 Score	Test 1 Decile	Test 2 Score	Test 2 Decile	Test 3 Score	Test 3 Decile	Test 4 Score	Test 4 Median	Test 4 Decile	Test 5 Score	Test 5 Median	Test 5 Decile	Test 6 Score	Test 6 Decile	Test 7 Score	Test 7 Decile
315	17.5	.707	6	52	6	48	9	160.1	4.1	8	176	8.1	3	.978	10	60	10
316	18	.423	1	21	1	25	1	318.4	11.9	2	265.2	8.0	1	.455	2	49	9
317	18.5	.70	5	37	3	43	6	173.2	6.7	7	121.8	3.2	6	.779	7	40	6
318	18.5	.733	6	55	7	48	9	196.4	6.5	6	84.0	3.2	9	1.00	10	42	7
319	18	.688	5	52	6	40	5							.792	8	27	1
320	17.5	.676	4	62	9	39	4	270.5	4.5	5	52.7	2.2	10	.65	5	39	6
321	18	.483	1	55	7	43	6	185	5.7	7	66.2	2.7	10	.792	8	41	6
322	18.5	.613	2	30	1	43	6	347.9	19.5	1	215.2	6.3	2	.348	1	44	8
323	16.5	.924	10	46	5	37	3	339.2	17.7	1	83.4	3.1	9	.760	7	38	5
324	18	.847	10					253.1	6.1	4	105.2	3.4	8	.542	5		
325	16.5	.615	3	52	6	45	7	266.5	6.5	3	132.6	4.7	5	.841	8	31	2
326	19.5	.626	3	46	5	39	4	151.2	3.6	9	269.2	9.8	1	.321	1	39	6
327	19.5	.797	8	63	9	50	9	212.2	5.9	5	66	2.4	10	.50	2	42	7
328	17.5	.884	9	63	9	53	10	200.2	3.4	5	80.8	1.8	9	.857	9	50	9
329	19.5	.70	5	45	4	45	7	154.6	3.4	8	141.6	4.8	4	1.111	10	34	3
330	17.5	.731	7	76	10	43	6							.709	6	18	1
331	17.5	.932	10	48	5	42	6							.599	4	46	8
332	19	.590	2	29	1	45	7	319.9	7.5	2	138.7	3.8	4	.752	7	39	6
333	18	1.00	10					301.4	12.3	2	92.7	2.5	8	.519	2	47	8
334	16.5	.98	10	37	3	32	1										
335	18.5	.736	7	60	8	40	5							.783	7	29	2
336	18.5	.685	5	83	10	53	10							.891	9	38	5
337	19.5	.615	3	57	7	39	4									28	2
338	18	.628	3	59	8	38	3	180.1	4.5	7	84.3	3.2	8	.460	2	45	8
339	25	.666	4	34	2	25	1							.338	1	17	1
340	18	.705	6	60	8	52	10							.548	2	31	2
341	19	.84	9	45	4	37	3									35	3
342	18.5	.300	1	40	3	40	5							.384	1	28	2
343	18	.687	5	57	7	60	10							.357	1	30	2
344	18.5	.805	8					194.7	4.6	6	189.6	4.8	2	.72	6	42	7

TABLE IV (continued)

Number	Age	Test 1 Score	Test 1 Decile	Test 2 Score	Test 2 Decile	Test 3 Score	Test 3 Decile	Test 4 Score	Test 4 Median	Test 4 Decile	Test 5 Score	Test 5 Median	Test 5 Decile	Test 6 Score	Test 6 Decile	Test 7 Score	Test 7 Decile
345	18	.586	2					376.1	16.6	1	104.5	3.2	6	.521	2	26	1
346	17.5	.641	4	63	9	45	7	149.6	4.4	9	72.9	2.4	10	.882	9	38	5
347	20	.683	4	51	6	39	4							.566	3	36	4
348	17	.810	9	32	2	44	7	271.9	6.2	2	78.4	3.2	9	.658	5	36	4
349	16.5	.637	3	48	5	47	8	237.7	5.5	3	108.6	3.0	6	.709	6	51	10
350	17.5	.90	10	36	3	35	2							.639	5	39	6
351	19.5	.541	1	34	2	47	8							.892	9	43	7
352	20	.704	6	57	7	40	5							.559	3	44	8
353	17	.70	5	63	9	41	5							.754	7	37	4
354	19	.797	8	25	1	28	1										
355	17.5	.601	2	34	2	37	3							.600	4		
356	17	.831	9	47	5	42	6	118.6	3.4	10	230.6	8.0	1	.931	9	49	9
357	17.5	.925	10											.779	7	29	2
358	20	.550	2	43	4	38	3							.704	6		
359	18	.662	4	67	9	34	2	155.5	4.9	8	83.8	3.6	9	.556	3	34	3
360	17.5	.589	2	42	4	41	5							.692	5	48	9
361	18.5	.790	8	41	4	41	5							.862	9	41	6
362	17.5	.792	8	43	4	33	1							.647	5	38	5
363	18	.594	2	34	2	38	3							.783	7	54	10
364	18.5	.622	3	27	1	40	5							.708	6	30	2
365	18	.503	1											.617	4	35	3
366	19.5	.752	7	57	7	44	7							.904	9	37	4
367	17.5	.775	8											.870	9	55	10
368	18.5	.669	4	42	4	40	5							.691	5	38	5
369	17.5	.713	6	39	3	45	7							.571	3	46	8
370	19.5	.739	7	36	3	40	5							.594	4	38	5
371	15.5	.746	7	50	6	39	4							.731	6	43	7
372	19	.731	6	53	6	48	9							.704	6	34	3
373	19.5	.511	1											.389	1	31	2

TABLE IV (continued)

Number	Age	Test 1		Test 2		Test 3		Test 4			Test 5			Test 6		Test7	
		Score	Decile	Score	Decile	Score	Decile	Score	Median	Decile	Score	Median	Decile	Score	Decile	Score	Decile
374	19	.764	7											.437	1	34	3
375	19.5	.811	9	59	8	51	10							.760	7	42	7
42'	18			48	5	34	2	231.1	8.1	3	172	3.05	3				
72'	18							218.2	7.3	4	105	2.7	6				
103'	17.5			68	9	44	7	206.8	5.2	5	154.3	4.0	3				
111'	16							263.1	5.0	3	180	5.5	2				
135'	19.5							267	8.4	3	130.2	3.5	5				
194'	20.5			61	7	51	9	175.7	4.1	6	136.8	4.0	3				
a	18.5			74	10	44	7										
b	17			58	7	37	3										
c	20			41	4	38	3										
d	17.5			41	4	42	6										

TABLE V

Scores according to age and year in high school

I. Cancellation										All
Ages	13	14	15	16	17	18	19	20	21 & over	
Freshmen	3	26	33	30	5	5	2	1		105
Median	.648	.594	.655	.654	.677	.644	.572	.522		.646
Sophomores	1	2	26	40	19	12	2	1		103
Median	.676	.560	.609	.620	.655	.574	.595	.832		.616
Juniors			3	24	34	13	14	1	2	91
Median			.666	.685	.693	.650	.644			.678
Seniors			1	5	30	24	17	4	2	83
Median			.746	.810	.706	.732	.686	.648	.663	.704
II. Dutch Homestead										
Freshmen	2	12	33	32	14	5	3		1	102
Median	30.5	31.5	41	32.5	33	51	16		49	34
Sophomores			8	37	26	15	6	1	1	94
Median			49.5	48	41.5	41	34.5	62	68	41
Juniors		1	1	9	29	21	4	1	2	68
Median		72	45	46	48	39	48.5	64	24	45
Seniors			1	3	16	30	18	9	3	80
Median			50	46	51.5	53.5	43	51	47	50
III. Marble Statue										
Freshmen	2	12	33	32	14	5	3		1	102
Median	44	40	40	37.5	37	37	20		47	39

TABLE V, Continued

	13	14	15	16	17	18	19	20	21 & over	All
Sophomores			8	37	26	15	6	1	1	94
Median			43.5	39	39	42	30.5	42	40	40
Juniors		1	1	9	29	21	4	1	2	68
Median		44	48	39	42	38	41.5	52	30	41
Seniors			1	3	16	30	18	8	3	79
Median			39	37	44	43	40	39.5	45	42
IV. Analogies										
Freshmen	1	17	16	12	2	2				50
Average	158	260	294	250	290	474				276
Sophomores		2	17	15	9	6	1			50
Average		232	244	290	284	324	304			276
Juniors	1	1	3	20	19	6				50
Average	110	172	178	252	240	314				246
Seniors				11	17	11	9	2		50
Average				202	206	234	234	160		214
V. Cause and Effect										
Freshmen	1	17	16	12	2	2				50
Average	64	210	232	176	200	266				208
Sophomore		2	17	15	9	6	1			50
Average	150	198	194	218	238	156				202
Juniors	1	1	3	20	19	6				50
Average	96	90	118	162	148	224				158
Seniors				11	17	11	9	2		50
Average				132	124	146	156	128		136

TABLE V, Continued

VI. Directions

Ages	13	14	15	16	17	18	19	20	21 & over	All
Freshmen	3	24	31	26	5	3	1	1		94
Median	.600	.498	.567	.501	.426	.335	.415	.419		.502
Sophomores	1	2	23	36	13	10	2			87
Median	.486	.723	.581	.525	.441	.421	.395			.524
Juniors			3	21	29	13	4	1	2	73
Median			.779	.576	.586	.666	.429	.818	.620	.600
Seniors			1	4	30	23	13	4	2	77
Median			.731	.735	.671	.752	.589	.649	.400	.704

VII. Word Building

Ages	13	14	15	16	17	18	19	20	21 & over	M	All
Freshmen	3	26	32	30	5	3	2	1			102
Median	36	30	31.5	30	29	34	24	23		30	
Sophomores	1	2	26	37	19	11	1	1			98
Median	31	31.5	36	31	32	32	36	31		33	
Junior			4	24	33	13	4	1	1		80
Median			46	37	37	41	35	53	53	38	
Seniors			1	4	29	23	16	2	2		77
Median			43	37	45	38	38.5	44	43	39	

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Vita

Wilford Stanton Miller was born January 6, 1883, in Raber, Indiana, and was graduated from the South Whitley, Indiana, High School, in 1900. From 1900 to 1907 he taught in the public schools of Whitley County, Indiana. From 1908 to 1910 he was Teaching Fellow in Indiana University, receiving the A. B. degree in 1910. He served in the same institution from 1910 to 1911 as Instructor in Educational Psychology, and the degree of A. M. was conferred upon him in 1911.

In February, 1911, he became Secretary of the School of Education and Assistant in Education in the University of Illinois. Leaving this position in 1916, he was appointed Assistant Professor of Education and Principal of the University High School in the University of Minnesota, which position he now holds.

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